FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 103
No. 2134
Registered at the G.P.O. as a Newspaper

SEPTEMBER 5, 1957
Offices: John Adam House, John Adam St., London, W.C.2

Single Copy 9d.
Post 1/- Annual Subscription, Home 40/-, Abroad 45/- (Prepaid)

SEP 27 1957

EAST ENGINEERING LIBRARY

Ask BERK for

BENTONITE & BERKBOND

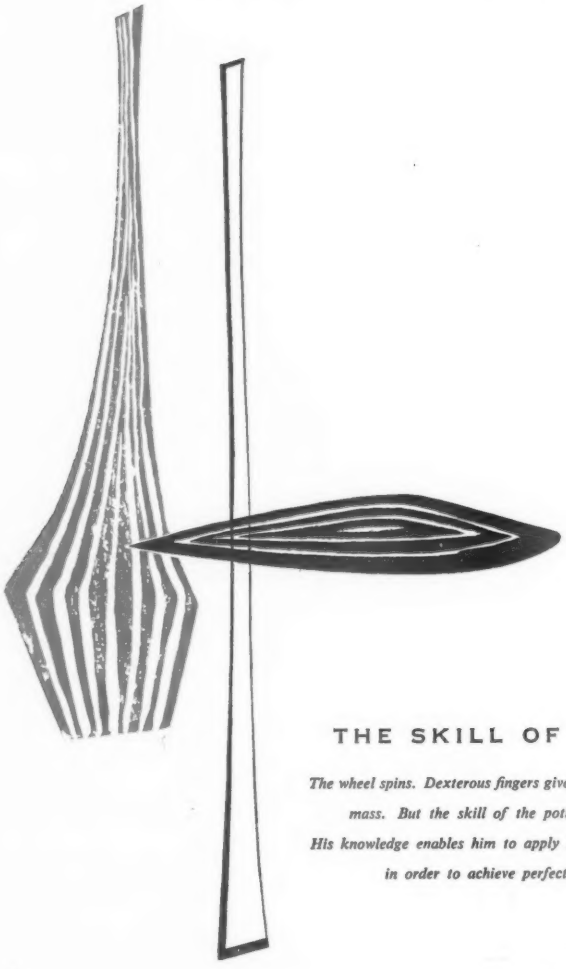
PROVED OVER THE YEARS

DISTRIBOND · WOOD FLOUR · SULPHITE LYE
BENTONITE & BERKBOND
FULL TECHNICAL SERVICE AVAILABLE

BERK CHEMICALS

F. W. BERK & CO. LTD.

COMMONWEALTH HOUSE · NEW OXFORD STREET · LONDON, W.C.1
TELEPHONE: CHAncery 6041 (16 lines) TELEGRAMS: "Berk, Westcent, London."



THE SKILL OF THE POTTER

The wheel spins. Dexterous fingers give form and character to a shapeless mass. But the skill of the potter has more than physical attributes. His knowledge enables him to apply secrets of his craft in order to achieve perfection in the creation of ceramics.

—but how about YOU, the non-ferrous Foundryman ?
Your craft involves more snags than most. Metal loss by fuming . . . harmful gas absorption . . . lack of fluidity . . . oxide inclusions . . . heavy slag and dross . . . you know them all. And the remedies ? Foseco CUPRIT for Copper and Copper Zinc Alloys, CUPREX and DEOXIDISING TUBES—for Copper and Nickel Alloys. Send for Leaflets PA1, 2 and 3.

FOSECO FOR PRODUCTS WORTHY OF YOUR SKILL

FOUNDRY SERVICES LTD., LONG ACRE, NECHELLS, BIRMINGHAM 7
Telephone : EASt 1911 (10 lines) Telegrams : "KUPRIT, Birmingham, Telex"

FOUNDRY TRADE JOURNAL

Established 1902

Vol. 103 Thursday, September 5, 1957 No. 2134

Editor:
V. C. FAULKNER, F.R.S.A., HON.M.I.B.F.
Assistant Editor: A. R. PARKES, M.I.B.F.
Commercial Editor: P. E. CARDEN.
Advertising Director: F. BARRINGTON HOOPER, B.A.
Production Manager: R. J. LOVELL.
Publisher: H. J. DWYER.
Circulation Manager: E. T. GRIFFITHS.
District Representatives:
G. P. ELLIOTT (*Northern Area*)
T. H. SMITH (*Scotland*)

PRINCIPAL CONTENTS

Technical : PAGE

Stockholm Diary, by A. R. Parkes: Continuation of the day-to-day commentary on social events, technical proceedings, and works visits of the International Foundry Congress held from August 19 to 24 273

Application of Sodium Silicate for Bonding Sands, by F. W. Nield and D. Epstein: Investigation into the use of four sodium silicates as bonding agents, in which the performance of the bond in terms of composition, control by dilution, chemical treatment, and changes of temperature are studied, the objective being to establish principles involved and optimum practices in application 279

Mechanite Training and Educational Group: Progress and activities at the foundry training school established by the group ten years ago 287

Co-operation in Technical Advancement in the British Bronze Foundry Industry, by A. R. French and E. C. Mantle: Abstract from a paper in which the Authors informed American foundrymen of the research work carried out by the Association of Bronze & Brass Founders in co-operation with the British Non-ferrous Metals Research Association . 293

Features :

Leader: Stockholm Congress . . . 271
Correspondence 272
Equipment and Supplies 285
Book Reviews and Publications Received 295

Commercial :

Company News 286
Raw Material Markets 298
Current Prices of Iron, Steel and Non-ferrous Metals 300

AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Weekly

Single copy 9d.; by post 1s.
Annual subscription: home 40s., abroad 45s. (prepaid)

17/19 JOHN ADAM STREET, ADELPHI, LONDON, W.C.2

'Phone: TRAfalgar 6171 (10 lines)
'Grams: Zacatecas, Rand, London

Stockholm Congress

In 1926, both the foundry and foundry-equipment industries were greatly disturbed by the then existing chaos as to the occurence of so-called international exhibitions and conferences. As a result, the International Committee of Foundry Technical Associations and the Foundry Trades' Equipment and Supplies Association, Limited came into being. Since that time, an orderly programme has been in existence with excellent results. No fewer than 24 international foundry congresses have taken place in eleven countries. The attendances have naturally varied, with probably America leading because of their great national support. The Congress just completed in Scandinavia attracted a higher registration of foreign visitors than domestic, the total being well over 1,000.

The earlier congresses almost invariably were associated with a foundry-equipment exhibition which was the main attraction. Attendance at the technical sessions was confined to the nationals of the organizing country plus a few enthusiastic visitors. Now with the advent of simultaneous translation services—especially where there is no exhibition to make competition—much larger audiences have been attracted. However, a new phase, which if not checked is guaranteed to empty the lecture theatres, has crept in. That is, certain scientists arrive with such voluminous notes, slides and the like, that they overstep the bounds of decorum, by occupying the platform for far too long periods. In truth, the fault must be laid squarely on the chairman for his indulgence in favour of a guest. Such contributions should be written and only an abstract given orally.

The Stockholm congress, viewed from no matter what angle, was an outstanding success. This was not just something that happened; it was the result of months of hard work by Mr. Lars Villner and his staff. The simultaneous translation was excellent as the interpreters were obviously familiar with the technical terms. The social events were chosen and carried through so well that, as is always the case with brilliant organizing, no organization was obvious. So, too, with the works visits where technical interest was of a high order and generous hospitality dispensed. Much was to be learnt from the works visits in Scandinavia especially as to means of heating and general ventilation, for the problems to be solved during the very winter months are more severe than in Great Britain. The replacement of silica sand by olivine in some foundries there, is a development which will be watched with interest by founders in this country. *Tusen Tack* (a thousand thanks)!

International Congress Awards

At the closing ceremony of the International Congress held recently in Stockholm, it was announced that Mr. Y. R. W. Granström, the general foundry manager of ASEA Vasteras, Sweden, has been made the recipient of the Olivo Award by the International Committee of Foundry Technical Associations, of which he was president in 1955. He is a graduate metallurgical engineer of the Royal Institute of Technology, Stockholm. Before assuming his present position with ASEA he was foundry manager at Norrahammars Bruk and works manager at A.B.W. Dan Bergman, Södertälje. The illustration shows Mr. Granström receiving the miniature of the award—"Perseus killing the Medusa" statue based on that by Benvenuto Cellini—which becomes his personal property. Making the presentation is Dr. A. B. Everest, this year's president of the Committee.

At the same ceremony, Mr. V. Delport received, at the hands of Mr. H. W. Dietert, president of the American Foundrymen's Society, the AFS "Service Citation" award, news of the granting of which was announced earlier this year. This award is intended exclusively as recognition for outstanding general service, primarily of a non-technical nature, to the Society and the foundry industry. The citation for Mr. Delport's award states that it is in recognition of his "distinguished service to the Society as its European representative, especially in connection with the international foundry congresses." Mr. Delport was a graduate of the *Ecole Centrale des Arts et Manufactures*, in Paris, in 1913. He first joined the U.S. Steel Products Company in the Paris office and then in 1924 took over the London office of the Penton Publishing Company, Limited, London, a position he has held ever since.

IBF Golf Meeting, September 28 and 29:

Members who intend to participate are asked to inform the golfing secretary—Mr. G. W. Nicholls, Modern Foundries, Limited, Halifax, before September 20.

BCIRA Producer/User Meeting in Glasgow

The British Cast Iron Research Association is organizing a one-day discussion on the engineering properties and uses of iron castings and the Association's services, to be held at the Central Hotel, Glasgow, on October 10.

This meeting is partly the outcome of a conference which was held in London in November, 1956, between producers and users of castings, and it is, therefore, proposed to restrict the attendance of the present meeting to Scottish members, at the same time inviting the participation of engineers and user organizations. The attendance is limited to a maximum of 100 persons, and an early application is advisable.

The meeting will begin at about 10.45 a.m. under the chairmanship of Mr. Ronald Taylor (Robert Taylor & Company, Ironfounders, Limited), who is chairman of the BCIRA Scottish Committee. Other BCIRA contributors include Dr. J. G. Pearce, C.B.E. (director), Dr. H. T. Angus (assistant director and development manager), and Mr. A. N. Summer (superintendent, Scottish Laboratories). These talks will be followed by a general discussion and the meeting will close at about 4.30 p.m. Luncheon has been arranged at the Central Hotel, and an attendance fee of £2 will be charged per person, including luncheon.

Applications to attend will be dealt with as they are received and should be sent to the BCIRA, Alvechurch, Birmingham, before the closing date, Friday, September 20.

Correspondence

FUME EMISSION FROM ARC FURNACES

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Successive correspondents to the JOURNAL lead the uninitiated to believe that: (1) It is deplorable that little is being done about arc-furnace fume control; (2) there is so little that at present can be done due to lack of knowledge on the subject, and (3) that one or two so-called progressive foundries are brilliantly pioneering a solution.

It should be pointed out that local state codes in the USA are, in many cases, far more stringent than those at present ruling in the UK. In spite of this, the American Air Filter Corporation have been successfully installing suitable equipment for some 20 years, and in so doing have accumulated a wealth of experience which is available to UK foundrymen. Perhaps your correspondents are blithely aware of this, but are aping the alchemists' quest for "Elixir," in seeking something for nothing.—Yours, etc.,

J. R. BICKLE.

17, Manchester Street,
London, W.1.
August 30, 1957.

Forty Years Ago

In the September 1917 issue of the FOUNDRY TRADE JOURNAL, the Editorial is concerned with the activities of merchants, as their position was being affected by Government trading, and the Merchants' Committee of the London Chamber of Commerce—and that was before the days of State monopolies! The installation of a works canteen at a Halesowen steelworks was then news of outstanding interest, but it was called a "messroom and workmen's club." It was opened by giving a free dinner to the men and a presentation to the managing director.

Stockholm Diary . . . By A. R. Parkes

Comment on Proceedings, Personalities and Events of the International Foundry Congress, 1957

(*Continued from page* 245)

This section of the report from Sweden's capital city, takes up the story with a brief account of the banquet held in the Town Hall and continues with abstracts from and comment on some of the technical papers and discussions. Details of awards presented, notes of sub-committee work and the closing ceremony remain to complete the diary next week. Illustrations are included to show something of the social side and a few of the personalities whose work, mainly behind the scenes, resulted in the huge success that the Scandinavians can justifiably claim for their Congress. Tabular matter records the strength of representation of countries among the delegates attending.

Banquet

Both the morning and afternoon of Wednesday at the Stockholm Congress were devoted to technical sessions, and that evening the magnificent City Hall was placed at the disposal of delegates for the annual banquet; this was held in Stockholm's *Stadshus* or Town Hall, a truly magnificent setting and with ample room in its main hall for the 1,000 attending this function. The hall is a remarkable piece of architecture; it was designed by Ragnar Ostberg and opened in 1923. The reception was held in one of the subsidiary halls where the walls were entirely of green and gold mosaic, comprising millions of pieces. The rough-brick walled dining hall was extremely lofty and without any pillar supports for the roof; its acoustics were excellent, and the whole place had an atmosphere of spacious elegance which contributed much to the dignity of the proceedings.

At the commencement of the dinner (for which the menu did ample justice to the occasion) the president (Mr. Lagercrantz) officially welcomed the company, saying that hitherto the main Congress interest had been founding but that night it was to be a pleasant social intercourse and relaxation and "talking shop" was banned. At this point, the main dish was carried in by a most impressive procession of 100 waiters and waitresses traversing a long balcony overlooking the hall and passing down the staircase. (See Fig. 1.)

The next speaker was Professor Ove Hoff of Denmark who proposed the toast to the ladies—speaking successively in English, French and German. Dr. Everest (president of the International Committee) responded to the toasts on behalf of the assembly. Each day of the Congress had led from wonder to wonder, he said, adding how deeply indebted to the city authorities were the delegates for permission to use the Town Hall, with its many works of art, statues and mosaics, for that night's banquet. All rejoiced and took pleasure in the friendly informality of the Swedes, but it was apparent in the conduct of the proceedings that they had a deep love of pageantry. Towards the conclusion of his speech, he disclosed that Professor Portevin of France, one of the founders of international collaboration amongst foundrymen, is to be awarded a C.B.E. by Queen Elizabeth II for his services in metallurgy to the world. After replying to Professor Hoff, Dr. Everest repeated the gist of his remarks in French and German and this concluded the speeches of the evening. Thereafter, dancing and friendly discourse continued until "Auld Lang Syne" at 1 a.m. put an end to the proceedings.

Ladies' Programme

Throughout the Congress, on occasions where the ladies did not accompany their menfolk—which meant nearly every day—special sightseeing programmes had been arranged for them. They paid visits, amongst others, to Drottningholm; Vällingby; Handarbetets Vänner (the handicraft association); Millesgarden and Valdemarsudde. At Drottningholm, they inspected the historic royal castle and a unique theatre at which, though it is 400 years old, the same seats and scene-shifting machinery is still used for to-day's shows. This proved so interesting that some of the party visited it a second time on one of their "free" evenings.

Other Works Visits

As has already been mentioned, Tuesday was devoted to works visits, and the Thursday was employed in similar fashion. During the trip to Finland, the men inspected the Högfors Bruk concern at Karkkila, while the ladies saw the enamelling shops of the first-named concern and went sightseeing in the area. Other works* visited during the Thursday included: SKF and AB Pump-separators Gjuterier, at Katrineholm; AB Järnförädling at Hälleforsnäs; AB Bolinder-Munktell and Bröderna Södersbergs Metallgjuteri, at Eskilstuna and AB Akers Styckebruk, at the place of that name. At all these, great welcome and lavish hospitality awaited the visitors and on occasion, souvenirs were given, as at Högfors Bruk, where a handsome cast figure of a bear, in the form of a

* A number of Swedish foundries, as well as some in Norway and Denmark, were described in the JOURNAL issues of July 11, 18, 25 and August 1, 1957.

wall plaque, by the artist Schilkin was presented to all who participated.

The parties that made the trip by special train to Eskilstuna were privileged also to visit, as an "extra" to the programme, the premises of the Johansson gauge works. Here after a preliminary tour of a shop solely devoted to the making of cycle chain, the processes of gauge production and checking to millionths of an inch were demonstrated and the firm's inspection facilities examined.

Technical Sessions

A total of 28 technical papers was presented and discussed at the Congress, the sessions occupying all day on Wednesday (August 21) and nearly all of the Friday. For the most part there were simultaneous sessions in different halls of the Parliament building. Each lecture had been preprinted (see page 295 of this issue) in one of the three official languages of the Congress and thus when presenting his contribution each lecturer was permitted 15 to 20 min. at the rostrum, in which to run over the salient points. The remainder of the time was allocated to discussion—also from the rostrum, so that simultaneous translation into the other two official languages could be arranged. Language difficulties also prompted the decision that all discussion contributions be prepared in advance or at least submitted in writing (at the time of delivery) to the Congress organizers for inclusion in the official report of the proceedings. Though these arrangements were logical and it is difficult to see any *prima facie* method of improvement, it did follow that discussion contributions were somewhat stilted and without some of the liveliness that arises from spontaneity. There was reluctance to pose a ten-word question requiring a plain "yes" or "no" from the author when this involved first the questioner and then the author in a solemn march to the rostrum. The system also led to slight abuse by some speakers who had prepared lengthy contributions almost amounting to papers of their own, complete with slides and sometimes also excursions into higher mathematics on the blackboard—the latter usually indecipherable. Surely such contributors had failed to measure the time necessary to deliver their contributions or they would have appreciated the discourtesy implied by monopolizing such substantial parts of the quite meagre discussion time? The chairmen were in a quandary in such cases as obviously they had no wish to appear to stifle discussion. The present writer puts forward the serious suggestion that in future, unless discussion is tending to lag, contributions in the hall should be limited by the chairman to five-minutes' delivery time each, and lengthy supplements to the lecture should find a proper place in the written account of the proceedings, where private study (by much wider audiences) could permit full appreciation of the arguments put forward and where the authors could append their considered replies.

FIG. 1 (*facing page*).—*Section of the main dining salon of the Town Hall, Stockholm, with the banquet of the International Foundry Congress in progress. Less than half the assembly is included, but the dignity and majesty of the setting is clearly revealed.*

Noteworthy Points

Notwithstanding these earlier remarks, the papers and discussion contributions were of a high order, and if some lacked fire, others had to be curtailed by the chairman after over-running the time allotted. Typical of the latter was the discussion of papers relating to the CO_2 Process, where contributions "booked" with the chairman in advance were so extensive that the authors of one of the Papers had to assert quite forcibly their right to reply. It is apparent from this session that, after the inevitable hiatus accompanying the introduction of this new process into foundrywork, it has suffered the equally inevitable set-back—where extravagant claims for its universal adoption have been routed—and now is entering on the phase of serious appraisal, careful research into *modus operandi*, and logical development of potentialities as just another "tool" at the disposal of foundrymen, with known limitations and defined parameters of applicability. British research* on this subject has done much to clarify the appraisal of the CO_2 Process and would seem to open the way for further exploitation, since it defines CO_2 hardening primarily as the process of increasing the viscosity of the silicate addition, it poses an optimum silicate : solids ratio for employment and explains the phenomenon of over-gassing. Another interesting contribution in the CO_2 Process discussion was one giving an eye-witness account (fully documented by reference to Patent applications) of the early trials with the Process by Hargreaves and Poulson in Lancashire which began at the end of the last century and continued in that area until 1920.

It was physically impossible for the present writer to attend all the sessions, and to that extent apologies are made if these remarks do scant justice to some of them. It is reported, for instance, that the papers on malleable iron—one disclosing research on a "bastard" material and the other a novel graphitizing process—were well received, as also were those on steelfounding. It was obvious, however, that some steelfounders are not yet convinced that Mr. Forsund's explanation of metal penetration into sand cores is 100 per cent. feasible, or do they all agree that the conclusions reached by Mr. Beckius on hot-tearing quite follow logically on the very valuable research work he disclosed. Nevertheless it is this very attitude of weighing-up and testing in the light of domestic experience which epitomizes the value of the Congress and is the real measure of its ultimate success.

Amongst the papers furnished by UK authors—a not inconsiderable proportion of the whole—

* A substantial abstract from the Paper by Mr. F. W. Nield and Dr. D. Epstein is printed in this issue of the JOURNAL

FIG. 2.—*Group of foundrymen and their ladies in the mosaic room of Stockholm's Town Hall.*

From left to right: Mr. J. Bell (IBF past-president); Mr. D. Craig (David Craig & Son, Limited); Mrs. Dietert; Mr. H. W. Dietert (AFS president), and (front row) Mr. and Mrs. T. H. Weaver (W. & T. Avery & Company, Limited).

those emanating from the British Cast Iron Research Association could be regarded as non-controversial contributions, that is, they added directly to the world's pool of knowledge of the subjects covered (*viz:*—pearlitic nodular irons and heat-treatment of spheroidal-graphite iron) in the form of incontestible facts. The discussion here showed that in this field the pronouncements of our research workers are regarded as highly valuable.

Working Conditions

Of the remainder of the papers, those which perhaps attracted the major interest of foundry owners—probably because of the world-wide movement towards improved foundry working conditions—were those dealing with health, welfare, training and ventilation of foundries. It was indeed regrettable that in this series there was no one either in a paper or in discussion to put "on the map" the valuable results of UK research and development in these and kindred matters. The writer is aware that this omission was to some extent deliberate and prompted by the already widespread publicity accorded in the technical Press to UK work on securing better working conditions in foundries. Nevertheless, it was disconcerting, to say the least, to realize that many of those speaking in Stockholm on these subjects exhibited no knowledge whatever of the nature or far-reaching implications of British research. Thus the writer found a considerable portion of this session was platitudinous, and without practical background in terms of quantitative measurement. For instance, dust-level measurement appears to be in its infancy on the Continent and remedial measures seem concentrated solely on air changes, without any reference being made to scientific design of such items as exhausting apparatus from grinders or high-velocity, low-volume exhausting at points close to the point of inception of dust.

A few novel points arising in this session are perhaps worth putting on record, however, and here the writer's notes reveal, *inter alia*, that olivine used for ten years in a foundry as a substitute for silica sand has proved innocuous as far as silicosis is concerned, though how much of a given improvement was due to the olivine and how much to other simultaneous changes, such as better general ventilation, was difficult to pin down. Olivine flour was reported by an American contributor to be safer than silica flour for metal-penetration protection for cores and moulds. A Swiss speaker said that in his foundry all workers were X-rayed at the time of their engagement, but the same speaker disclosed that silicosis could be latent in certain persons and yet become virulent even after 10 years' working in the open air. A third speaker (a Swede)

FIG. 3.—*Mr. B. Lagercrantz (president of the Congress), Dr. A. B. Everest, F.I.M. (president, International Committee) and Dr. G. Schwietzke (vice-president, International Committee) examine a CO_2-hardened core prepared from a die of an old seal.*

reiterated what has already been regarded as proved as holding for UK foundries, namely that fettlers can contract the disease in shorter periods of exposure than iron-moulders.

Other contributions included the information that one way to eliminate bad odour arising during core-baking was to lead the fumes to the fire-box of the stove; that ten per cent. of a man's hourly rate of pay is barely sufficient to cover the cost of adequately ventilating his workplace (even neglecting maintenance) and that winter heating of Swedish foundries by itself accounts for 80 per cent. of the running cost.

Other Discussions

The paper by R. Namur on the degree of effectiveness of feeder heads according to design, size and location was described by its author as an extension to practical working of formulæ previously developed and published. A British contributor said the mathematics of the paper were frightening to him but its conclusions useful. In contradistinction to Mr. Namur's work, he added that UK work in similar fields had been to improve and develop thermic conceptions of feeding, *e.g.*, by the application of heat-producing and conserving media to ameliorate the heat-flow conditions within a cast mould and hence secure directional solidification. Another speaker queried the rôle of pressure in feeding mechanisms but the author, to the writer's mind, rather glossed over this point by saying merely that it was assumed sufficient metal pressure must be provided, without mentioning how and in what degree.

The next paper, by J. S. Abcouwer, on pouring times for sand castings, was mainly concerned with the practical establishment of optimum filling times for moulds of various types and designs. A formula based on the minimum wall thickness in relation to the mass had been applied, but one speaker, describing his own successful application of the precepts enunciated, thought the effect of mass had been overweighted in establishing the formula. (A point of constructive criticism might be injected here as to the slides used at technical meetings to illustrate graphs. Generally speaking, authors try to crowd too much on to a slide. They should first ascertain the size of lantern screen being used, project each slide at this maximum and then view it themselves from the furthest point away which the hall to be used will permit. The result, by being unintelligible, will often astonish the author and convince him to reorientate his ideas of what can usefully be "put over" by a lantern slide. What has been said of graphical expressions also applies to the mathematical type—a slide shown for a minute or two only is not the best medium for displaying complicated formulæ.)

TABLE I.—*Participants Registered for the Stockholm International Foundry Congress.**

	Delegates.	Ladies.		Delegates.	Ladies.
Australia ..	2	2	Japan ..	10	—
Austria ..	12	6	Luxemburg ..	2	1
Belgium ..	15	3	Netherlands ..	19	9
Czechoslovakia	15	—	Norway ..	23	11
Denmark ..	19	7	Poland ..	9	—
Eire	3	2	Portugal ..	1	—
Finland ..	23	10	Roumania ..	2	—
France ..	79	61	Spain ..	31	18
Germany ..	175	96	U.S.S.R. ..	6	—
Great Britain	55	30	Sweden ..	123	49
Hungary ..	1	—	Switzerland ..	20	8
India	4	1	U.S.A. ..	10	6
Israel ..	1	—	Yugoslavia ..	9	—
Italy	35	11	Total ..	704	331

* Latecomers brought the figure to over 1,050.

FIG. 4.—*Mr. Lars Villner (Congress general secretary) enjoys a chat with Mrs. M. M. Hallett at one of the Congress functions. (As Mr. Villner was ultimately responsible for all the detail of the Congress organization, it is doubtful if he managed to get many relaxed moments during the period!)*

High-duty Malleable

The discussion of Mr. Thyberg's paper* on high-duty malleable contained apologies from the author that all opportunity for extending the observations had ended with the cessation of manufacture by his firm of this type of material. Thus he was unable to report on the impact properties of the material in respect of varying silicon content, except for the lower grades (5 and 6) of this type of iron. Similarly, in reply to an English founder's query, he said that too much inference should not be drawn from Table II, which reflected results only from a limited series of experiments. The questioner had said the elongation/silicon values were surprising if the carbon content were assumed constant, and Mr. Thyberg replied that it was really a "bastard" blackheart malleable which was being made and it was probably a surface effect which was reflected in the elongation figures quoted. On the effect of nickel, he said this was present as contamination from back scrap, and other conditions may have changed during the experiments, which precluded any inferences being drawn as to whether this element, on balance, acted to stabilize or accelerate breakdown of the structure. Discussing further the subject of inverse chill, Mr. Thyberg inserted an account of the work of Morrogh and Palmer, of the BCIRA, about the effect of un-

* Paper printed in this JOURNAL, August 22, 1957.

Stockholm Diary

necessarily-high manganese in causing such structures and the means the British authors had proved to be effective for their elimination.

Notes on the technical sessions should not be closed without mention of the fact that—on the strength of a paper from Mr. H. W. Dietert and his colleagues from America, supplemented in discussion by mention of a Swedish installation—the long-standing problem of continuous moisture metering of moulding sand and its automatic tempering appears to have been overcome. The paper described the method of working of equipment available in America for this purpose and detailed its capabilities, mentioning that it employed rapid and repeated estimation of water content in the sand by means of high-frequency capacitors inserted at the mill, which were so connected electronically as to operate two water-dispensing valves, one capable of large-quantity delivery and the other for fine adjustment. It appeared that this apparatus is best suited to batch milling and, in fact, questions were directed during discussion towards ascertaining its suitability for continuous milling installations, the reaction to high-temperature sand, and the incorporation of safety devices. Shortness of time unfortunately precluded further elaboration of this subject, which is of major interest to all operators of large mechanized foundries.

(To be continued)

DSIR Orders Another DEUCE Computer

Five Deuce computers will be in Government service by next spring. The latest order for a machine has been placed with the English Electric Company, Limited, by the Department of Scientific and Industrial Research's mechanical engineering research laboratories at East Kilbride, Scotland. Others are at the DSIR's National Physical Laboratory, Teddington, RAE, Farnborough, and the Atomic Weapons Establishment, Aldermaston.

The most recent installations of DEUCE have been made at the London offices of the British Petroleum Company, Limited, and at Short Bros. & Harland, Limited, Belfast. The machine for East Kilbride, the first to be equipped with high-speed paper tape as well as punched-card input, will be employed mainly in calculations in hydro and thermo-mechanical problems.

Large US Tonnage Oxygen Plant

Described as the largest ever built for a steel mill, an oxygen-producing plant recently installed at US Steel's Duquesne Works is expected to give a 25 per cent. increase in ferro-manganese output. The plant has a capacity of 500 tons of oxygen a day and provides the following: Oxygen of 95 per cent. purity, (about 90 per cent. of the output), goes directly to two ferro-manganese blast furnaces. The balance is oxygen of 99.5 per cent. purity, which is supplied to pipelines servicing electric furnaces, scarfing and cutting operations and other applications. There is also a supply of liquid oxygen for standby storage.

The Linde concern, which built the new plant, according to *Iron Age*, June, will own and operate it and provide supplementary service, bringing in oxygen from outside plants to meet peak demands.

Delta Metal Profits Satisfactory

An interim dividend of 10 per cent., less tax, has been declared by the directors of the Delta Metal Company, Limited. This rate is the nearest practical equivalent to the 6 per cent. free of tax declared by way of interim dividend for 1956, and is payable on the capital as since increased from £1,750,000 to £2,000,000 by an issue of shares against acquisitions. Profits for the current year are being maintained at a satisfactory level, and in the absence of unforeseen circumstances the board hopes to make a final distribution of 20 per cent., less tax, equivalent to the aggregate of last year's final tax-free dividend of 9 per cent. and the tax-free bonus of 2½ per cent. which were paid on the present capital.

In the event of the company's offer to acquire the whole of the ordinary share capital of James Booth & Company, Limited, non-ferrous metal manufacturers, of Birmingham, being accepted, the directors intend to circularize the company's shareholders giving full details of the transaction. The final distribution referred to above would be payable upon the shares issued to the Booth shareholders in accordance with the offer, but not the interim dividend.

Newman, Henders' Capital

Erection of a new factory and the provision of new plant, machinery, and equipment for Newman, Hender & Company, Limited, iron and non-ferrous founders, of Stroud (Glos), is expected to cost at least £250,000. In addition, it is anticipated that in order to finance the additional stocks and customers' credit facilities to support increased sales, at least £300,000 additional working capital will be required.

The company therefore proposes a one-for-one scrip issue and a rights issue to raise about £400,000, details of which will be announced as soon as possible after the annual meeting on September 19. The authorized share capital is to be increased from £900,000 to £1,600,000 by the creation of a further 1,500,000 ordinary 10s. shares.

Group net profits for 1956-57 are £180,384 (£179,225) and the dividend is raised 5 per cent. to 25 per cent. on a capital increased by a two-for-five rights issue.

British Firms Win Large Argentine Contracts

Argentine contracts, worth over £1,500,000, have been won by two British firms in competition with 37 firms from the US, the Netherlands, France, and Japan. The contracts are for the construction of a large number of power generating plants to be installed in rural areas. The two firms are Henry Meadows, Limited, Wolverhampton, and the Brush Group, Limited.

The Brush Group's £1,250,000 order is for generating sets from 100 kw to 1,000 kw. They will be made by Mirrlees, Bickerton & Day, Limited, Stockport (39 sets), and the National Gas & Oil Engine Company, Limited, Ashton-under-Lyne (82 sets). All the electrical equipment for these sets will be made by the Brush Electrical Engineering Company, Limited.

FAIREY MARINE COMPANY, LIMITED—Mr. L. S. Dawkins has been appointed to the board. Mr. Dawkins is secretary of the Fairey Aviation Company, Limited, and is also a director of the Fairey Aviation Company of Canada, Limited.

Application of Sodium Silicate for Bonding Sands*

[*Abstract*]

By F. W. Nield and D. Epstein

Four sodium silicates, of $SiO_2 : Na_2O$ ratios: 2.0, 2.5, 2.9 and 3.3, were investigated as bonding agents for a silica sand. The bond was produced by passing CO_2 through cylindrical standard test-pieces and the relationship between compression strength and gassing time was established. Test-pieces cured this way and uncured were subjected to temperatures up to 1,200 deg. C. and tested in compression. An attempt to explain the chemical reaction was made and differences in behaviour of the four silicates were studied.

The purpose of this Paper is to establish the relationship between the compression strengths of sand bonded with sodium silicate, cured by CO_2 and uncured, and: (1) the grade of sodium silicate; (2) its concentration; (3) the time of gassing for cured test-specimens, and (4) the temperature to which the test-specimen is subjected. To determine this relationship, one sand and four grades of sodium silicate were used. An attempt was made to establish a rule governing the performance of the bond in terms of composition, control by dilution, chemical treatment and change of temperature.

$SiO_2/Na_2O/H_2O$ System

The term sodium silicate embraces mixes of three incredients, *viz.* silica (SiO_2), sodium oxide (Na_2O) and water. It is possible, by varying the percentages of these three components, to obtain a range of materials with widely different physical characteristics, either homogeneous or not. All the possible variations of composition are represented by points lying inside a triangle (Fig. 1). From this graph, it can be seen that the homogeneous liquids suitable for bonding foundry sands occupy a very small field of the possible combinations of the three ingredients. It is customary to express composition of sodium silicate by the "total-solids content," which gives the sum of the silica (SiO_2) and sodium-oxide (Na_2O) contents and the silica: sodium oxide ratio expressed either on a molecular or a weight basis.

The facts on which further considerations are based are: (1) The silica: sodium-oxide ratio in homogeneous sodium-silicate solutions available in the industry lies within the limits 1.0 to 4.0 approximately, on a weight basis, and outside these limits the liquids are unstable and tend to produce another phase. (2) The higher the ratio, the higher the viscosity for the same solids content. The rise of viscosity with the rise of ratio is extremely rapid as can be seen from Fig. 2[1].

(3) In sodium-silicate solutions, whether one starts from the meta-silicate Na_2SiO_3, di-silicate $Na_2Si_2O_5$ or tetra-silicate $Na_2Si_4O_9$ ($Na_2O.4SiO_2$) the ions in normal concentrations will be Na^+ and SiO_3'', or Si_2O_5'' etc. Due to hydrolysis H^+ and OH' ions will be present and because of the low strength and dissociation of all these acids the OH' ions will be in excess, producing an alkaline reaction characteristic of all sodium silicates. (In the chemical industry some grades having $SiO_2 : Na_2O$ ratios greater than 2.8 are called neutral.) Passing CO_2 through sand coated with sodium-silicate solution causes a chemical reaction which binds the Na^+ ions with CO_2 dissolved in the aqueous solution of sodium silicate. This is an ionic reaction and only dissolved CO_2 or carbonic acid (H_2CO_3) takes part in it. The balance between Na_2O and SiO_2 in the system $Na_2O/SiO_2/H_2O$ becomes disturbed and it can be considered that the $SiO_2 : Na_2O$ ratio rises, which must produce a rise in viscosity.

(4) The speed of drying of sodium-silicate/sand mixes depends on the ratio of $SiO_2 : Na_2O$. The higher the ratio, the quicker is the drying. High-ratio sodium-silicates will set more quickly than low-ratio sodium-silicates, even if their water content is higher initially (within certain limits).

Materials Used

Sand. For all the tests, Redhill "F," washed silica-sand was used.

* Paper presented at the International Foundry Congress, held recently in Sweden.

Dr. David Epstein, at present chief chemist of F. & M. Supplies, Limited, graduated in 1933 from the chemistry department of Warsaw Technical College. He then worked as a chemist, and later as chemist and production manager in the cereal and carbohydrates industry in Poland. During 1947-8 he was a member of the Research Staff of the *Institut du Batiment et des Travaux Publiques* in Paris. In 1948 he joined the technical staff of F. & M. Supplies, Limited, and took up his present appointment in 1950.

Mr. F. W. Nield, technical development manager of F. & M. Supplies, Limited, was educated at the Manchester College of Technology. He has held appointments with the Admiralty, at Glasgow University, and Plessey Company, Limited. In 1942 he was appointed chemist and foundry metallurgist at the mechanized grey-iron foundry of Henry Wallwork & Company, Limited, and held this appointment until 1953, when he went to F. & M. Supplies, Limited. Mr. F. W. Nield has been secretary to the Lancashire branch of the IBF for the last six years.

Sodium Silicate for Bonding Sands

Silicates. Four grades of sodium silicate of the properties shown in Table I were used.

Procedure

All sand mixes were prepared in the same way by mixing sand with various percentages of sodium silicate in a roller-type sand mixer. The mixing time was three min. and the amount of sand mixed in all cases was 3 kg. Test-specimens for compression strength were rammed three times in a split corebox, by an AFS standard rammer. Gassing of the standard test-pieces was carried out with CO_2 at a pressure of 0.7 kg. per sq. cm. (10-lb. per sq. in.). The CO_2 pressure was regulated by means of a pressure-reducing valve; the rate of flow was maintained at a constant figure and checked using

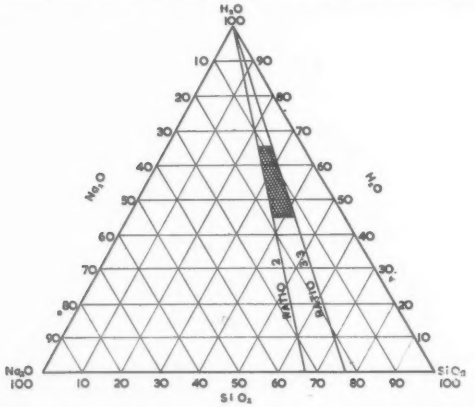


FIG. 1.—*Composition triangle; showing the field of sodium silicates available for foundry use.*

a flowmeter. All CO_2-cured test-pieces were tested against uncured specimens at all temperatures. The time of heating the test-specimens to high temperatures was 30 min., both in the oven up to 250 deg. C. and in the muffle furnace to 1,200 deg. C. Test-specimens on leaving the oven and muffle furnace were cooled to room temperature before tests for compression strengths were carried out.

Results

Gassing. It was found that with sodium silicate having a $SiO_2:Na_2O$ ratio of 2.0, maximum strengths were not reached after eight min. of gassing; with the other three sodium silicates maxima were reached. The higher-ratio sodium-silicates reached maximum strength more rapidly but the lower-ratio sodium silicate attained a higher maximum strength.

Elevated Temperature

The earlier maximum strengths were taken at room temperature. To establish the strengths at higher temperatures, test-pieces both cured and uncured, were simultaneously placed in the oven or muffle furnace at about 100 deg. C. intervals, and the compression strengths recorded for these were plotted separately for each temperature and a number of graphs were prepared. Figs. 3 and 4 being typical examples of graphs made separately for each ratio.

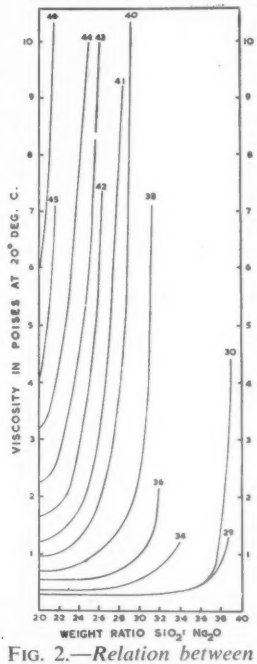


FIG. 2.—*Relation between viscosity and the silica: sodium-oxide ratio of sodium silicate. The figures indicate total-solids content.*

Observations

These figures and the character of the curves obtained in the Authors' experiments agree generally with the results published so far by the majority of other research workers who have indicated the grade of sodium silicate they were investigating. The lower-ratio sodium silicates commonly used in foundry practice give the strongest cores, although these grades of sodium silicate have the worst collapsibility on casting. The conclusions reached however, on surveying the figures quoted, differ in some considerable manner from the rules which are generally assumed to govern the CO_2 Process, thus:—

(1) it is generally accepted that in the CO_2 Process, the bond holding the sand particles together is due to hydrated silica-gel. The reaction is represented by an equation of the type:—

$$Na_2SiO_3aq + CO_2 \rightarrow Na_2CO_3 + SiO_2aq;$$

TABLE I.—*Four Grades of Sodium Silicate Employed in the Experiments.*

Grade.	Mean weight ratio, SiO_2Na_2O.	Mean molecular ratio, SiO_2Na_2O.	Typical analysis of solids, per cent.			Specific gravity, at 20 deg. C.	Viscosity at 20 deg. C. (centipoises).
			Na_2O.	SiO_2.	Total solids.		
C 112	2.0	2.05	15.2	30.4	45.6	1.56	800
100 ORD	2.5	2.6	12.45	31.10	43.53	1.50	400
M 75	2.9	3.0	9.15	26.40	35.55	1.375	100
No. 1	3.3	3.4	8.8	29.0	37.8	1.395	250/500

It is also generally accepted that the strength of the silica gel produced reaches a maximum when the gel contains a certain percentage of water.[2, 3] However, if the strength is due to the silica gel, it should be in direct proportion to the silica-gel content in the sand. In this case, test-pieces made of sand bonded with silicates of higher ratio and cured, should be stronger than when bonded with sodium silicate of lower ratio. This is not borne out by the Authors' graphs.

TABLE II.—*Compositions of Sodium Silicates in the Sand Mixtures.*

Ratio.	Water.	SiO_2.	Na_2O.
2.0	3.22	1.19	0.59
2.5	3.22	1.27	0.51
2.9	3.22	1.32	0.46
3.3	3.22	1.37	0.41

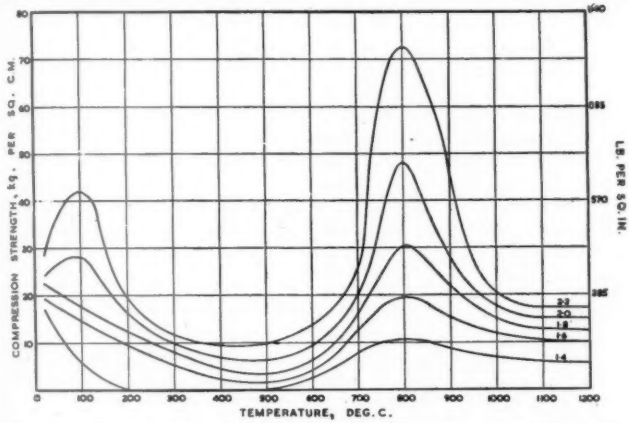


FIG. 3.—*Relation between compression-strength and temperature for specimens prepared, using a sodium-silicate ratio of* 2.5 *to* 1.0 (*cured*).

To eliminate the important factor of water content, the four sodium silicates were diluted to the same concentration (35.55 per cent. of solids) and 5 per cent. of each was added to the sand. In this way, the 5 per cent. of sodium silicate in the sand had in each case a composition as indicated in Table II.

Fig. 5 shows the relationship between compression strength and gassing time, the maximum strength depending on the sodium-silicate : sodium-oxide ratio and gassing time. The lower the SiO_2 : Na_2O ratio, the longer the gassing time to reach the maximum compression strength, but the higher the maximum strength reached. It would thus appear that:—(*a*) the bond of these test-pieces is produced by silica gel; (*b*) it is a weak bond, and (*c*) it is quickly destroyed by continued gassing. The amount of gel present in sand is in direct proportion to silica content, *i.e.* the sand with sodium-silicate 3.3 ratio contains about 15 per cent. more of gel than sand with sodium-silicate 2.0 ratio. In spite of this, the first sand has a lower compression-strength. (One can neglect the influence of the optimum percentage of water in silica gel, as the gassing starts with about 65 per cent. of water in the binder and this percentage is progressively reduced.)

(2) The rate of destruction of the bond by continued gassing varies with the type of sodium silicate. It would appear to be a reasonable assumption that it is not due to "over gassing" in the chemical sense. The change of sodium carbonate to sodium bi-carbonate does not appear to affect the strength of the bond. What probably happens is that the silica gel dries out. This drying out progresses much more rapidly with higher-ratio sodium-silicates than with those more alkaline. To prove this point, CO_2 and air were passed through test-pieces for a fixed period of time, the amount of CO_2 being increased in each successive test, Fig. 6 illustrates typical results.

(3) It is known that siliceous sodium-silicates dry quicker than those more alkaline; sands bonded with silicates of high-ratio dry quicker than those bonded with silicates of low ratio; the strength of the bond produced by silica gel from high-ratio silicates falls more quickly than the strength of silica gel from low-ratio silicates.

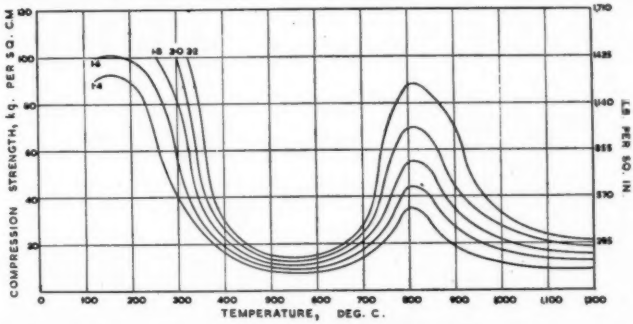


FIG. 4.—*Relation between compression-strength and temperature for specimens having a sodium-silicate ratio of* 2.5 *to* 1.0 (*uncured*).

The reason for these phenomena may be a common one; probably they could be explained by the hygroscopic properties of sodium oxide (hydroxide) in the case of silicates and of sodium

Sodium Silicate for Bonding Sands

carbonate in the case of silica gel. This property is apparent not only when the drying is effected by passing CO_2 or air, but also by subjecting the sand to elevated temperatures (see, for example, Figs. 3 and 4).

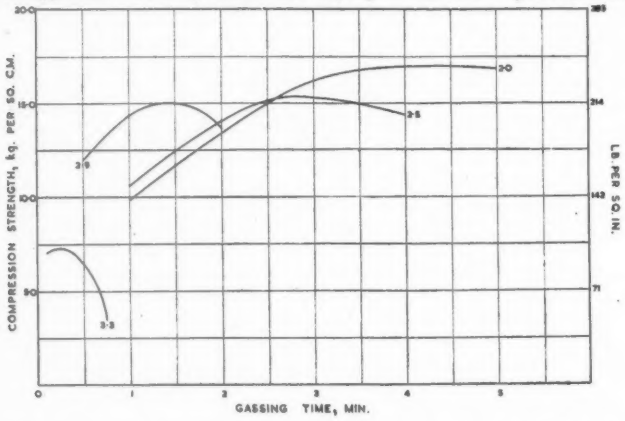


FIG. 5.—*Relation between compression strength and gassing time. All sodium silicates contained 35.55 per cent. of solids and 5 per cent. was added to the sand.*

(4) The reasonably-strong bond produced quickly by passing CO_2 through silicate-bonded sand, which made the process so popular in the foundry industry, is probably not due to silica gel. Instead, it is the viscosity of *sodium silicate* in the sand which rises so high that the sodium silicate becomes practically solid, and thereby produces the bond. This bond can be achieved only by using sodium silicates of low ratio, for the following reasons:—

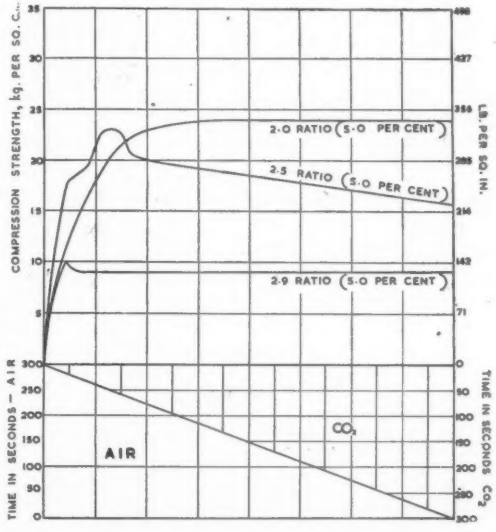
The higher the silica:sodium-oxide ratio of a sodium-silicate with a given solids content, the higher its viscosity. This is why when a high-ratio sodium-silicate is required of the same viscosity as a low-ratio silicate, its solids content has to be reduced. By raising the ratio from say 2.0 through gassing with CO_2, the viscosity is increased many thousands of times before the ratio reaches the point when silica precipitates (see Fig. 7)[1].

By passing CO_2 through silicates of high ratio the limit of $SiO_2:Na_2O$ will quickly be reached beyond which the solution becomes unstable and silica-gel precipitates. Since the ratio and viscosity of the homogenous liquid have thus been lowered, it is then possible to dissolve a further quantity of CO_2 until the reaction is completed and all the silica is precipitated. The bond of this sand will be due entirely to hydrated silica-gel. On curves showing the relation between strength and gassing time, the compression strength rises to a certain maximum which marks probably the completion of the reaction. Further passing of CO_2 causes a drop in compression strength. It would appear that this is due to drying of the silica gel and the same effect could be produced by other gases. Fig. 6 shows the change in compression strength of test-pieces bonded by one of the four grades of sodium silicate diluted to the same solids content and gassed, first by CO_2 and then by air for a period of 5 minutes.

It was found impossible to maintain any strength in the test-pieces with the 3.3 ratio sodium silicate after 300 seconds gassing; this set of test-pieces were gassed, therefore, for 60 seconds only (this graph is not reproduced here). The four curves differed very much in character. Ratio 2.0 sodium-silicate increased the strength with continued gassing with CO_2 up to a certain limit. This figure was maintained at a constant level whether the gassing was by CO_2 or air; probably after the first period there was no chemical reaction. Ratios 2.5 and 2.9 showed a characteristic local maximum. This may be due to the high viscosity achieved by raising the $SiO_2:Na_2O$ ratio. The viscosity was not high enough to stop the reaction and continued passing of CO_2 produced a drop in strength; probably silica gel had been precipitated, and the bond produced was lower than the bond of the high-viscosity silicate.

In the case of 2.9 sodium silicate, the strength did not depend on which gas was passed. With

FIG. 6.—*Relation between compression strength and periods of passing CO_2 and air over a constant total time.*


COMPRESSION STRENGTH, kg. PER SQ. C.M.
LB. PER SQ. IN.
2·0 RATIO (5·0 PER CENT)
2·5 RATIO (5·0 PER CENT)
2·9 RATIO (5·0 PER CENT)
TIME IN SECONDS — AIR
TIME IN SECONDS CO2
AIR
CO2

2.5 sodium silicate, the strength kept falling as more CO_2 was passed—it is possible that the reaction had not been fully completed when the local maximum was reached, and that more silica gel is formed when more CO_2 is passed through. The strength is lowered since more sodium-silicate bond is replaced by silica-gel bond. This was in agreement with the results for the 3.3 ratio sodium-silicate. Here, the reaction had been completed as for 2.9 ratio sodium-silicate, but the local maximum was not observed probably owing to the difficulty of measuring such low strengths. As seen earlier, further gassing (drying) of ratio 2.0 sodium-silicate increases its strength. In this case, it is not the drying of the silica gel but of the sodium silicate which increases its strength by reducing the moisture content.

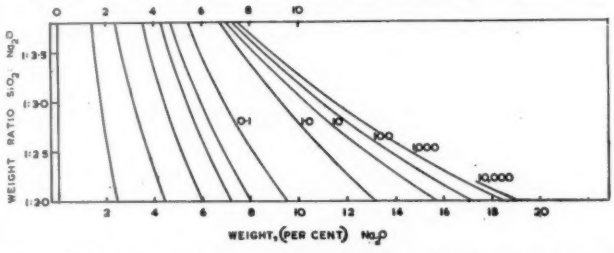


FIG. 7.—*Variation of viscosity (in poises) with SiO_2:Na_2O ratio and Na_2O content of sodium silicates.*

As a rule it can be established that, when the reaction has been completed, the strength of the bond due to silica gel will drop either on standing, passing gas or on heating (this is due to the destruction of silica gel by dehydration). When the reaction caused by CO_2 has led only to an increase in the viscosity of sodium silicate the reaction will ultimately be arrested by the increasing viscosity and the strength of the bond due to the viscosity will rise on standing, passing gas or heating to 250 deg. C. This is only possible with sodium silicates of low ratio.

The behaviour of test-pieces at higher temperatures generally confirms the findings published by other authors, although an exact comparison is not always possible because either the grade of sodium silicate used is not known or the strength tests are not comparable[4].

If the assumptions made in the foregoing are correct, it is possible to forecast the behaviour of 2.0 ratio sodium silicate when diluted. It would be possible to dilute it to such low concentration that because of its low initial viscosity the passing of CO_2 would complete the reaction. The test-piece would show a fall in strength when subjected to higher temperatures. Fig. 8 shows the two curves; one for 1.78 per cent. solids; the test-pieces represented by this curve contain 2.12 per cent. water. The other curve marked by a broken line represented a sand into which 5 per cent. of the same silicate, but diluted to 35.55 per cent. solids, has been mixed. This sand also contains 1.78 per cent. solids, but 3.22 per cent. water. It can be concluded from the broken line that the diluted silicate has been decomposed and that the silica gel has been destroyed by drying.

When heating to 600 deg. C. and above, there is a rise in the compression-strength of the test-pieces. It is generally accepted that this is due to the re-fusion of silica with sodium carbonate or sodium silicate. However, the strength obtained by this process in the uncured test-pieces is not as high as the strength obtained by heating at lower temperatures (about 200 deg. C.). This could possibly be explained by the fact that at higher temperatures the sand participates in the reaction and that some of the silica in the sand is re-fused. This produces glass of higher silica : sodium-oxide ratio and it is therefore weaker.

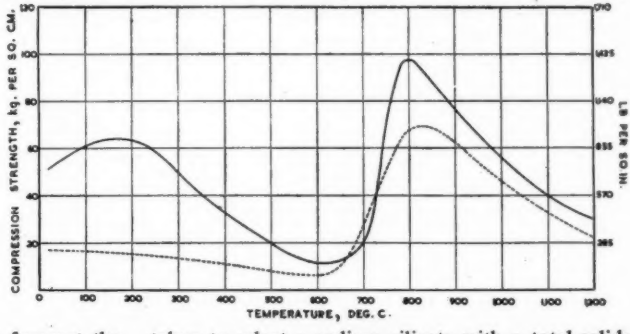


FIG. 8.—*Relation between compression-strength and temperature for two sands bonded with sodium silicate ratio* 2.0. *Key: Solid line—sodium-silicate ratio* 2.0 (45.6 *per cent. solids*) *and broken line — sodium-silicate ratio* 2.0 (*diluted to* 35.55 *per cent. solids*).

Conclusions

(1) The CO_2 Process bond is due to sodium silicate which has had its viscosity increased *in situ* by gassing with CO_2.

(2) With the CO_2 Process, only sodium silicates of low ratio, about 2.0, are suitable for use in foundry practice.

(3) When selecting a grade of low-ratio sodium silicate to meet any given conditions, care must be taken to select a sodium silicate with a total-solids content which will not produce a gel on gassing with CO_2.

(4) As the amount of CO_2 normally used is greatly

Sodium Silicate for Bonding Sands

in excess of that actually required for curing, it could be reduced by dilution with air.

(5) Blowing hot air or stoving cured cores for short periods at about 100 to 200 deg. C., will increase (up to approximately 50 per cent.) the compression strength. In certain cases this will permit a reduction in the percentage addition of sodium silicate.

(6) An addition of water-retaining materials will improve the bench "life" of sodium-silicate sand mixes.

(7) The CO_2 present in air does not shorten the bench life of sodium silicate sands nor does it react with the binder in gassed cores in any appreciable way. The changes which do take place are due to drying.

(8) Breakdown of CO_2-bonded sands after casting depends on (*a*) the temperature reached in various parts of a core and (*b*) on the percentage and ratio of sodium silicate in the sand.

Acknowledgments

The Authors wish to express their thanks for the help given by Mr. J. Bugg and Mr. L. A. Watkins of F. & M. Supplies, Limited, London. They also wish to thank the directors of this firm for permission to publish the work.

REFERENCES.

[1] James G. Vail. "Soluble Silicates," 1952.
[2] A. M. Lias. *Liteinoe Proizvodstvo*, 1956, No. 2 App, pp. 31-35.
[3] D. V. Atterton. *Journal* of the British Steel Castings Research Association, June/August, 1956.
[4] W. Schumacher. *Giesserei*, November, 1955, No. 24, pp. 653-659.

Expansion of Triplex Foundry

With the acquisition of Henry Harrison & Sons, Limited, manufacturers of locks and keys, Mr. William H. L. Harrison, chairman and joint managing director of Triplex Foundry, Limited, Tipton, Staffs, becomes head of a firm which his great grandfather founded nearly 70 years ago. Besides acquiring his great grandfather's business, Mr. Harrison has also bought for Triplex the Vowles Aluminium Foundry, Limited, of West Bromwich. This foundry, which produces castings for the engineering trade, employs 400 men on the production side. It is only two years ago that Triplex bought up the Great Bridge Foundry Company, Limited, in order to widen its range of foundry products, and Mr. Harrison, who had been managing director at Great Bridge for ten years, moved over to Triplex.

Import Duty Drawback on Machinery Parts

An order has been made by the Treasury providing for the payment of drawback of Customs duty on the export of springs, nuts, bolts, bolt ends, screws, washers, tubes, and pipes, which are specialized parts of machinery.

The Order—the Import Duties (Drawback) (No. 14) Order, 1957 (SI, No. 1494)—came into operation on Tuesday of last week.

Casting Cannon

By Frederick Evans, M.B.E., M.A.

The first cannon, such as those used by the English at Crecy in 1346, were made of longitudinal bars of wrought iron held by hoops around the gun. Because these early cannon were used to fire heavy-stone shot they had to be of large bore and so they would be too large to be made conveniently by casting brass or bronze. The smelting of iron in blast furnaces did not become common in this country until the reign of Henry VIII, so that in the days of Crecy only wrought iron from the bloomeries and forges which were working in places like the Forest of Dean, the Weald, Staffordshire, etc., was available. Examples of such wrought-iron cannon still remain. Mons Meg in Edinburgh Castle has a bore of 20 in. and fired a granite shot weighing 330 lb. A gun of this kind left by the English in Normandy in 1423 has a bore of 19 in. Smaller guns firing iron shot came into use in this country in the 16th century, when also blast furnaces for smelting were introduced from France. Thus the casting of cannon in the iron-working regions of this country became possible. Already the casting of bronze guns to fire a smaller iron shot had become popular in the same century.

The first cast-iron cannon made in England came from Buxted in Sussex in the 16th century and the founder was a Ralph Hogge or Hoggett. At first the barrels were cast hollow with a central core put in the mouth for the bore but even with reaming it was difficult to get a true calibre by this method, but Maritz of Geneva, in 1739, introduced a machine for boring guns from the solid. This was worked by water power like most blast furnaces and trip hammers in that period.

As the power of gunpowder was increased by better methods of manufacture, the breech end of the gun became thicker until the almost bulbous outline of the muzzle-loading cannon of the earlier parts of the 19th century became the accepted pattern. Then with the discovery of cordite, of methods of winding steel wire and of shrinking on additional steel casings to the barrels, the elongated profile of the modern gun appeared which, indeed, repeats that of the original straight barrel of the wrought-iron days: another cycle in design.

Duke to Visit Yorks. and Lancs.

Details of visits by the Duke of Edinburgh to industrial undertakings in Yorkshire and Lancashire are announced. On October 24 the Duke will go to the East Hecla Works of Hadfields, Limited, the Sheffield steelmakers, while on November 22 he will open the new works of the Metropolitan-Vickers Electrical Company, Limited, at Wythenshawe (Lancs).

On the same day he will also open the extension of the Manchester College of Science and Technology and visit the guided weapon research laboratory of Ferranti, Limited, at Wythenshawe.

Equipment and Supplies

Oxygen Lance

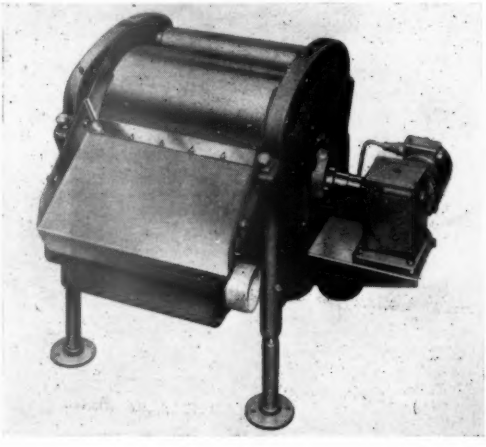
The use of an oxygen lance at the Wordsley (Worcs) factory of Fry's Diecastings, Limited, is facilitating the recovery of metal from crucibles, used for the melting of aluminium bronze and brass. Occasionally, they prematurely collapse with the result that the contents fall into the furnace chamber. After cooling, a disc of metal of up to 36-in. dia. and from 3- to 7-in. thickness is formed, depending on the furnace dimensions. In view of the fact that normal furnaces are not sufficiently large to melt discs of metal of this size, it is necessary to cut them into small pieces, for removal. This is now effected by means of an oxygen lance, designed by British Oxygen Gases, Limited. The lance, a standard 21-ft. length of ¼-in. steel gas-tubing, is packed with ⅛-in. dia. pure-aluminium and mild-steel rods, and oxygen is then passed through at a pressure of 90 to 100-lbs. per sq. in. The discs of metal are removed from the furnace when solidified, but still hot, and a standard oxy-acetylene cutting blowpipe is used to start the reaction of the lance. The addition of the rods provides the oxidizable material, lacking in the metal which is being cut, and enables sufficient heat to be generated to melt the non-ferrous disc, along the line of cut.

Magnetic Separator for Coolants

Rapid Magnetic Machines, Limited, of Lombard Street, Birmingham, 12, have increased their range of magnetic equipment, by the introduction of a coolant separator (Fig. 1) which has been designed to remove impurities, sludge, etc., from suds and other coolants. The contaminated liquid is fed through a restricted area between the separator housing and stainless-steel cover of the magnetic-drum, which is energized by powerful Alcomax permanent magnets fitted around its periphery. This drum rotates in the opposite direction to the flow of liquid. Ferrous particles in the liquid are thus attracted to the cover of the drum, and discharged on to a chute at the front of the separator after passing under a roller, which squeezes out the liquid remaining in the sludge. Cleaned liquid then flows from side outlets, located near the front of the separator, and is available for re-circulation.

These equipments are available in a wide range of capacities from 10 gall. per min.—in increments of 10—to approximately 40 gall. per min.

FIG. 1.—*Separator, manufactured by Rapid Magnetic Machines, Limited, Birmingham, for removing magnetizable impurities from suds and other coolants used in machining processes.*



Roller Conveyor

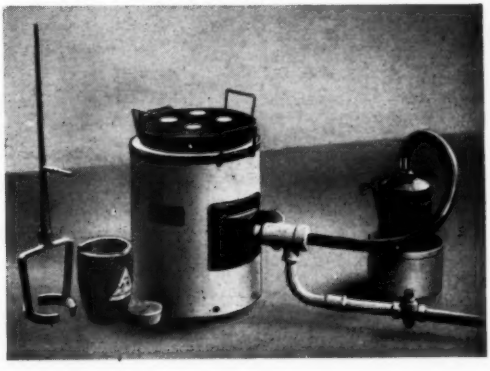
During the last few years, many varied and improved roller conveyors have been introduced and among the latest is a range marketed by J. Collis & Sons, Limited, of Regent Square, Gray's Inn Road, London, W.C.1. One of this range appears to be suitable for heavy foundry use, and is sold under the trade name of "RóloVeyor," Model heavy-duty P, with a loading capacity of 700-lb. per roller. It is fitted with precision ball bearings, which are pressure lubricated. The conveyor is supplied in standard lengths of 8 ft., either in straight or curved sections; assembly, which is claimed to be both rapid and simple, is aided by the easily adjustable height, and stable, stands. Additional standard units can be supplied, among these are junctions; turnover fork section, with swing-out unit; turntable links, and a double-lift unit for bridging wide gangways.

KEIGHLEY GRINDERS LIMITED, a subsidiary of the Newall Engineering Company, Limited, have added a fully-automatic internal grinder to their range of precision-grinding machines. Arranged for both gauge and diamond sizing, the new machine is designed for grinding holes from ¼- to 6-in. dia. to a maximum depth of 6-in. A swivelling workhead provides for grinding taper bores up to 60 deg. included angle.

Miniature Crucible-furnace

Claimed to be suitable for use in schools, or for experimental purposes, a small-capacity (10-lb. of aluminium) lift-out crucible furnace has recently been introduced by Morgan Crucible Company, Limited, Battersea Church Road, London, S.W.11. Three models are available, one for paraffin, one for coke and one for gas heating (Fig. 2). One of the latter was recently demonstrated at Hartford Secondary Modern School in Cheshire.

FIG. 2.—*Gas-fired miniature crucible furnace and accessories manufactured by Morgan Crucible Company, Limited, London.*



Company News

NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED—Consideration of payment of a dividend on the 5 per cent. cumulative preference stock is deferred until results for 1957 are available. The dividend has been paid to March 31, 1956.

MODERN ENGINEERING MACHINE TOOLS, LIMITED—Final dividend for the 15 months ended March 31 is 15 per cent., making 30 per cent. for the period. For the previous year a single dividend of 10 per cent. was paid. Group net profits for the period were £54,669 (£21,546 for year), after allowing £78,908 (£26,315) for tax.

UNITED FIRECLAY PRODUCTS, LIMITED, Glasgow—The Woodall-Duckham Construction Company, Limited, announces that its offer to purchase the 1,240,000 shares of 5s. in the company, has been accepted by the holders of more than 90 per cent. of such shares. Accordingly, the offer has become unconditional.

WILLIAMS & WILLIAMS, LIMITED, makers of metal windows, doors, etc., of Chester—The 12½ per cent. dividend is maintained and group profits have expanded from £206,927 to £331,209. The net profit is £188,567 (£88,441) and, deducting profits of minority interests of £10,635 (losses £19,401), there is £177,932 (£107,842), attributable to the holding company.

TRIPLEX FOUNDRY, LIMITED—The first stage of the group's reorganization has now been completed and it is expected to return to a profit-earning basis in the current year. A loss of £56,209 (£13,262 loss), of which £40,000 arises from exceptional amounts written off stocks, is reported. This was after crediting income-tax recoverable £16,110 (£3,799). As for 1955-56 there is no dividend on ordinary.

A. V. ROE (CANADA), LIMITED—The company has now received the necessary consents to raise $24,000,000 in Canada. Sir Roy Dobson, chairman and managing director, stated on August 27 that as a result, the official offer for the capital of the Dominion Steel & Coal Corporation, Limited, can now be made. In spite of one or two dissentients to the offer, he thought that the difficulties were now on the way to be resolved in view of the latest, and more favourable, reaction to the bid.

A. & J. MAIN & COMPANY, LIMITED, structural engineers, etc., of Glasgow—Profits before tax were £204,031 (£182,643 before £22,085 Pakistan exchange loss). Results were not achieved by a high rate of profit but by "moderate profits on a turnover which is large in comparison with the capital." The ordinary dividend is 10 per cent. less tax (same) with an additional 4½ per cent. (nil) tax free, which is being distributed in view of the tax credit for previous years' adjustments.

ALBRIGHT & WILSON, LIMITED, chemical manufacturers, of Oldbury, Birmingham—For the half-year ended June 30, 1957, a net profit of £664,000 (£556,000) is shown. There is £646,000 (£539,000) attributable to the parent company. A 5 per cent. interim (same) is declared. Reduction in profits because of the transfer last year of the US subsidiary, Oldbury Electro-Chemical Company to Hooker Electrochemical Company in exchange for shares, was more than offset by improved results in the rest of the group.

JOHN DALE, LIMITED, non-ferrous founders, etc., manufacturers, of London, N.11—The company's offer to acquire the common stock of Modern Containers, Limited, Toronto, Canada, has been accepted. Modern Containers is a public company, and has, for more than 20 years, been a leading manufacturer of collapsible tubes and plastic closures for the Canadian market. John Dale, Limited, is raising its interim dividend by 2½ per cent. to 10 per cent. in respect of 1957. Last year's total was 22½ per cent.

JAMES HOWDEN & COMPANY, LIMITED, marine and general engineers, of Glasgow—Together with the announcement of a 20 per cent. final to make an unchanged 25 per cent. total for the year ended April 30 last, the directors announce a one-for-four rights issue. This will involve the issue of 546,000 ordinary 10s. shares which will be offered at 40s. each, equivalent to 20s. per 5s. unit. Group profits for 1956-57, after all charges except tax, were higher at £1,124,820 against £1,063,674. Taxation amounted to £562,232 (£536,439).

MONSANTO CHEMICALS, LIMITED—Net sales of the company and its UK subsidiaries for the first half of this year were £7,930,927, the highest recorded for any first six months and an increase of 14.4 per cent. over the £6,934,343 for the corresponding period of last year. Export business rose by 24 per cent. Net income, before taxes, was £870,738, against £787,722. Estimated taxes are £443,200, against £404,200, leaving net income of £427,538 (£383,522). For the full year 1956, net sales were £14,034,947, net income, before taxes, £1,544,079, and the net balance £835,104. Figures in all cases exclude the Australian subsidiary earnings. An interim of 5 per cent. is declared on the ordinary capital as doubled by cash and capitalization issues, and it is stated that although keen competition and increasing costs are limiting the benefits of the higher turnover, the directors see no reason to amend their view that the year's results should justify a total dividend of 13½ per cent.

Increases in Capital

AIRCRAFT METALS, LIMITED, London, N.W.1, increased by £79,900, in £1 shares, beyond the registered capital of £100.

JOHN THOMPSON, LIMITED, Wolverhampton, increased by £750,000, in 5s. ordinary shares, beyond the registered capital of £2,400,000.

SANDVIK SWEDISH STEELS, LIMITED, Birmingham, increased by £190,000, in £1 ordinary shares, beyond the registered capital of £10,000.

DARWINS, LIMITED, steelmakers, of Sheffield, increased by £270,000, in 10s. ordinary shares, beyond the registered capital of £1,180,000.

M.R.L., LIMITED, engineers, etc., of Barnet (Herts), increased by £10,000, in £1 ordinary shares, beyond the registered capital of £15,000.

ORMOND ENGINEERING COMPANY, LIMITED, London, E.C.2, increased by £300,000, in £1 ordinary shares, beyond the registered capital of £100,000.

CROMIL & PIERCY, LIMITED, engineers, etc., of Newcastle-upon-Tyne, increased by £22,000, in £1 ordinary shares, beyond the registered capital of £8,000.

CONSTRUCTIONAL ENGINEERING COMPANY, LIMITED, Birmingham, increased by £25,000, in £1 ordinary shares, beyond the registered capital of £25,000.

WILLIAM ROBERTSON, LIMITED, steel bar and wire manufacturers, of Warrington, increased by £100,000, in £1 ordinary shares, beyond the registered capital of £100,000.

A. C. BAMLETT, LIMITED, agricultural engineers, etc., of Thirsk (Yorks), increased by £25,000 10s., in 33,334 shares of 15s each, beyond the registered capital of £49,999 10s.

MORLEYS (BIRMINGHAM), LIMITED, iron, steel, and metal merchants, etc., of Birmingham, increased by £48,000, in £1 ordinary shares, beyond the registered capital of £12,000.

DRAYTON REGULATOR & INSTRUMENT COMPANY, LIMITED, Yiewsley, West Drayton (Middx), increased by £225,000, in 2s. ordinary shares, beyond the registered capital of £300,000.

MARKLAND SCOWCROFT, LIMITED, general engineers, etc., of Bromley Cross, near Bolton, increased by £100,000, in £1 ordinary shares, beyond the registered capital of £100,000.

DESIGNEX (COVENTRY), LIMITED, tool, pattern, and machinery designers, etc., of Coventry, increased by £19,000, in £1 shares (17,000 ordinary and 2,000 "E" non-voting), beyond the registered capital of £26,000.

Meehanite Training and Educational Group

Ten-years' Experience of a Foundry Training School

This year, the Meehanite Training and Educational Group celebrates the tenth anniversary of its inception, and the following article details the great progress made by this pioneer installation.

Immediately after the war years, foundry managers throughout the country were seriously concerned at the steady loss, through age, of their skilled moulders and the lack of youths coming into the industry, for training in this important trade. The licencees of the International Meehanite Metal Company are brought together at frequent intervals for discussion of problems arising in the industry and in connection with the development of Meehanite metal. It was not surprising therefore, that the problem of the intake of apprentices soon became a topic of conversation and as a result a number of the licencees decided to get together to see what could be effected to overcome the problem. The first meeting occurred in July, 1946.

The group consists of the following licencees:—Alley & MacLellan, Limited; Ashmore, Benson, Pease & Company, Limited; J. Blakeborough & Sons, Limited; Butterley Company, Limited; Cameron & Roberton, Limited; Douglas Fraser & Sons, Limited; Glenfield & Kennedy, Limited; Goulds Foundries, Limited; John Harper (Meehanite), Limited; John Hastie & Company, Limited; Holman Bros., Limited; Qualcast (Ealing Park), Limited; Ransomes & Rapier, Limited; Richards Foundries, Limited; Winget, Limited, and The I.M.M. Company, Limited.

It was decided to form a group known as the Meehanite Training & Educational Group, having as its object "the furtherance of training in the foundry industry and to have regard to all those matters which may have an effect on the recruitment, training and education of labour for Meehanite foundries."

Operational Details

In furtherance of the object it was decided that a training school for moulders should be established; as regard the financing of this venture, the initial costs were to be divided amongst all members of the group, and adjusted as new members joined. Running costs were to be apportioned to each firm in relation to the number of their boys attending the courses. Good castings were to be sold to members of the group, whose patterns were concerned, with a view to assisting in the finances of the school. It was emphasized that this financial consideration was not to detract from the principal object of the school, which was to train good craftsmen.

Reflecting on ten years of successful operation of both the group and the school, it is interesting to see how farsighted were the original founder members. Little alteration has been necessary in the constitution and rules, and the school is operating almost exactly as originally planned. Originally it was proposed that the day-to-day working should be controlled by an executive committee but later this was altered. The quarterly meetings of the group are attended by one member from each participating foundry, together with the secretary, treasurer, and a member of the International Meehanite Metal Company. This has proved an eminently practicable arrangement and one great strength of the group has been the personal interest and hard work put in by the firms' representatives, who are usually directors or managers.

The Butterley Company offered to provide the space and facilities for the school at Butterley where it started and still operates. Apprentices, who must be not under the age of 15 and must have no less than one year's previous foundry training, are subject to the Butterley Company's rules for administration and discipline. Although in operation from November 25, 1946, the school was officially opened on April 18, 1947, by the Mayor of Derby, when prominent members of foundry organizations and Meehanite licencees were present. Since that time, well over 100 boys have completed the school curriculum for four courses, each of one month's duration, spread over a period of two to three years. Many of these boys have now completed their apprenticeship with their own companies and having since carried out their National Service, are now working as fully skilled moulders and are proving the value of their training at the school. Many of them indeed have now risen to positions of responsibility.

Objects

The prime object of the school is to train boys for the craft of moulding, and this has always been kept in the forefront of the group's policy. The school is run by a competent instructor who is himself a skilled moulder and has certain technical qualifications. The courses are designed to knit into the type of work which the boy is doing at his own foundry at his particular age. By the time the fourth course is reached, the boy will be in his 19th or 20th year and difficult work is then given him, to test his increasing craftsmanship. The practical work is interspersed with periods of theoretical training, and typical syllabuses for the first and final courses are detailed in what follows. Phases of the training given in the various courses are illustrated in Figs. 1 to 6.

School Curriculum

First Course: Use of tools, cleanliness; orderliness of working; elementary moulding, including

FIG. 1.—*Group of apprentice moulders and their instructor (left) in the Meehanite Training School at Butterley.*

the two-part box; irregular joints and odd-sides; elementary knowledge of moulding sands for green-sand work; permeability; bond and moisture; function of coal dust; simple casting defects—causes and remedies; oil-sand practice, and simple core-making.

Second Course: Simple weight calculations; casting defects—causes and remedies; blast-furnace works visit; chief impurities of, and influence of constituents on cast iron; shrinkage and contraction—patternmaker's allowance; more advanced use of lifters and "soldiers"; three-part boxes; running and gating systems and slag traps; skin drying, and machine drawing.

Third Course: Introduction to loam moulding; the cupola furnace and its operation; physical and mechanical properties of grey iron and Meehanite; mechanical testing; visit to analytical laboratories; synthetic sand; permanent and semi-permanent moulds; dry-sand practice; mixing and use of blackings; more advanced moulding—drawbacks and lifting grids; machine drawing; open sand work; bedded-in moulds and castings defects—causes and remedies.

Final Course: General revision; progressive solidification—isotherms; fluid pressure; pyrometers and fluidity test; safety-first and hygiene; advanced casting defects—causes and remedies, concluding with a lecture—"The Meehanite Moulder and His Place in Industry."

Arrangements are also made during the training periods for the boys to visit other works in the district. These visits have proved most instructive and have given them an opportunity of seeing various methods of production in the allied industries, from the making of pig-iron to the highly-mechanized plants for the production of various types of castings.

It will be seen that due regard is paid to cleanliness, safety precautions and good operation in the foundry. It is realized that many boys who take up moulding have little interest in theoretical work and in fact, may not greatly benefit from it, but nevertheless, this is encouraged both at the school and when the boy returns to his own firm. It is often found that a boy may dislike theoretical work at an early age, but as he matures, he appreciates its interest and value.

To promote smartness at the school, boys are issued with overalls with a suitable badge on the pocket. These become their own property, which they then wear at the parent foundries. Recruits come from Meehanite foundries scattered all over Great Britain, so that it is common for boys from England, Scotland, and Wales to be working together. It may be thought that this might lead to some difficulties but such is the discipline and good sense of the instructor, the comradeship engendered by the atmosphere of the school, and the boys' pride in the craftsmanship, that trouble is rarely experienced.

At the conclusion of each course, the instructor submits reports on each boy to his parent firm, and prizes are awarded by the group to the two boys doing the best practical and theoretical work in each course. At the conclusion of the fourth course, he is issued with a certificate covering the

results of all the courses; on the completion of his apprenticeship he is considered for the award of the Diploma, which is based on the results he has obtained both during his attendance at the school and his performance at his own foundry. The International Meehanite Metal Company also awards a special prize each year to the most outstanding boy who has completed the full four courses and obtained the Diploma. As a further incentive the two best boys of each year, together with the instructor, attend the annual Meehanite Research Institute conference which was held, last year, in Holland, the cost of sending the instructor and these two boys to the conference being borne by the group. It will be appreciated that the privilege of attending the conference is very much sought after and is a further incentive.

Reading through the minutes of the group it is interesting to see how few have been the real disturbances with which the group has had to deal.

FIG. 2 *to* 5.—*Other phases of training at the Meehanite school: Fig.* 2 *shows a lecture in progress; Fig.* 3, *gassing a core with* CO_2; *Fig.* 4, *coring-up a floor mould, and Fig.* 5, *transferring molten metal to a double-hand shank.*

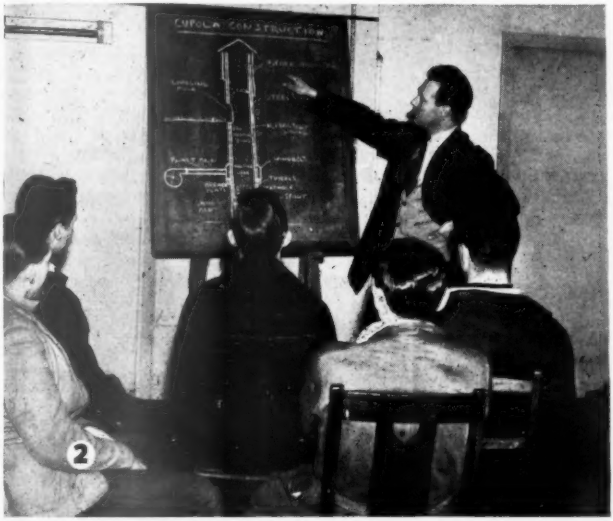


FIG. 6.—*"The proof of the pudding!" — apprentices and their instructor critically examine the finished castings.*

Minor troubles have occurred at times in connection with lodgings but these have never been of a really serious nature. The school has become a model for the industry and it has had many visitors to see how the work is carried out, including the Manchester Joint Trading and Recruitment Committee with the late Mr. Tom Makemson as a member, the Amalgamated Union of Foundry Workers with its secretary, Mr. Jack Gardner, etc., and other visitors from abroad.

The activities of the group have not been confined to operation of the school, and it will be seen that the original constitution provides for all matters concerned with recruitment, training and education of labour for the industry. The group also has been responsible for running special training courses of different characters, the first held at Butterley in 1948, consisting of a combined practical and theoretical course mainly for men employed by members of the group who had their training interrupted by war service. A refresher course for metallurgists was held in York in September, 1949, followed by a similar course in October 1950. These courses led to a regular series of foremen's and metallurgists' courses taking place biennially in various parts of the country.

Patternmakers' Course

Following discussions on the training of patternmakers, it was felt that in many foundries the patternmaker apprentice was not fully aware of the problems arising in the foundry, from the utilization of defective patterns. To improve this state of affairs a number of courses have now been held for patternmaker apprentices, these being based on the moulders course, but the curriculum modified to drive home the lessons required. They have proved successful and are now a regular annual event; needless to say the practical work is adjusted to ensure that boys attuned to patternmaking are not overstrained by the hard work such as bending and carrying metal to which the moulder apprentice has become acclimatized.

A further development has been the holding of an adult training course, designed to give junior executives a better idea of the problems arising on the foundry floor. The men who attended this course have been selected from such widely varying jobs as salesmen, cost accountants, estimators, draughtsmen and even a trainee managing director, for whom emphasis is based on the theoretical rather than the practical aspect of the work, and including discussions on matters such as quality control, fundamentals of cupola operation, sand, etc., led by prominent members of the firm concerned. The men attending these courses are usually housed in a hotel where they can get together in the evenings and discuss the day's work or enjoy each other's company in social affairs.

A list of courses held at the school is shown in Table I.

TABLE I.—*Foundry Training School Courses (including Patternmakers and Adult Courses), Commencing November 25, 1946, to March 29, 1957.*

Year.	Foundry course.	Pattern-makers' course.	Adult course.	Total.
1946 ..	1	—	—	1
1947 ..	11	—	—	11
1948 ..	9	—	1	10
1949 ..	11	—	—	11
1950 ..	11	—	—	11
1951 ..	10	—	1	11
1952 ..	10	1	—	11
1953 ..	7	2	1	10
1954 ..	9	1	—	10
1955 ..	10	1	—	11
1956 ..	10	1	1	12
1957* ..	3	—	—	3
TOTAL ..	102	6	4	112

* This figure applies up to March 29, 1957, only. A total of 277 boys have attended foundry classes, and 41 have attended patternmaking courses, whilst 43 men have taken the adult course.

It will be seen that after ten years operation it is a lively and vital concern; members of the group are never satisfied with the work which they are doing, and there is a constant search for new ideas together with criticisms of the working of the school and its other activities. Credit for the great success of this venture must be given first to the enthusiasm and sound planning of the originators of the scheme. Perusal of the minutes made it abundantly clear that the foundations of the scheme were well and truly established. So far as the school is concerned, much of its success has been due to the care and devotion which the Butterley Company and its general foundry manager has given to the work. All concerned can be proud to feel that much has been done well for the youth of the foundry industry.

Farnborough Air Show

It is pleasing to note that the total number of "free" and "tied" foundries, exhibiting their products in the 1957 Farnborough Air Show, has increased substantially over previous years. It is thought by many founders that the main reason for this is the fact that over the last few years, the precision and quality of castings has been improved, with the development of processes such as investment casting and shell moulding. Aircraft designers are now increasingly calling for castings whereas previously they had specified fabricated components. It is hoped that this trend will continue at an ever increasing rate, as the advent of new processes and alloys improves the founder's field.

The Show and exhibitions opened on September 2 and close on September 8; the following paragraphs are published as a guide to those sections of the exhibition of major interest to founders.

D. NAPIER & SON, LIMITED (stand B)—Gas-turbine aero-engines and castings produced by the Napiercast method, and aircraft models.

BIRMINGHAM ALUMINIUM CASTING (1903) COMPANY, LIMITED (stand 115)—Castings in magnesium "Elektron," magnesium/zirconium and aluminium alloys for the aircraft industry, by sand, gravity-die, and pressure-die-casting processes.

BRITISH OXYGEN GASES, LIMITED (stand 248)—Specialized argon-process equipment for automatic and spot welding and cutting. The spot welding process, using a composite rectifier unit, is shown on airframe construction. "Saffire" gas-welding and cutting equipment.

BRITISH THOMSON-HOUSTON COMPANY, LIMITED (stand 170)—Electrical equipment for aircraft including a.c. and d.c. motors and generators, auxiliary generating plant, high-temperature silicon rectifiers, magnetos, switches, circuit-breakers, electronic engine testers.

J. BROCKHOUSE & COMPANY, LIMITED (stand 245)—"Chatwin" engineers' small tools and cutters; and "K" die-castings, both gravity and pressure.

DAVID BROWN INDUSTRIES, LIMITED (FOUNDRIES DIVISION) (stand 264)—High-tensile steel castings for air-frames; heat-resisting steel castings for gas turbines; precision castings; "Taurus" bronze castings, gears, gear units, gear-cutting tools, and patented floating-reamers.

DESOUTTER BROTHERS, LIMITED (stand 142)—A full range of power-tools including: straight, corner, and rackfeed drills; rivet and bolt millers; countersinking tools; spanners; shears; nibblers; grinders; screwdrivers and nut-runners.

FIRTH-VICKERS STAINLESS STEELS, LIMITED (stand 118)—"Staybrite" stainless, heat and creep-resisting aircraft steels in the form of castings produced by the centrifugal, centri-die, static and investment processes.

HADFIELDS, LIMITED (stand 308)—Steel castings and forgings; turbine discs, stator rings for exhaust gas turbines, precision castings, heat-resisting and alloy steels, stainless steel, and shell-moulded castings. An outstanding exhibit is a stressed rear-spar casting for the Hawker "Hunter."

HEPWORTH & GRANDAGE (YEADON), LIMITED (stand 93)—A range of turbine blades incorporating "Hepolite" blades which are used in the latest jet and turbo-prop engines, together with a number of castings, including piston-rings, liners and pistons.

HIGH DUTY ALLOYS, LIMITED (stand 144)—Sand- and die-castings, forgings, stampings, extrusions, sheet and plate in "Hiduminium" and "Magnuminium" alloys; forgings in titanium; blades in "Hiduminium," aluminium bronze, stainless steel, "Nimonic" and titanium.

KENT ALLOYS, LIMITED (stand 218)—Sand, die-cast and shell-moulded castings to AID specifications in aluminium, magnesium, magnesium "Elektron" zirconium, copper alloys, iron and steel; machining; argon arc welding; X-, and gamma-ray inspection, and final assemblies.

JOSEPH LUCAS (GAS TURBINE EQUIPMENT), LIMITED (stand 129)—Research, design, development and manufacture of fuel pumps; control systems; combustion equipment; space and anti-icing heaters; hydraulic pumps and hydraulic motors.

LOCKHEED HYDRAULIC BRAKE COMPANY, LIMITED (stand 53)—Undercarriage equipment; modern civil and military-aircraft hydraulic equipment (including pumps, cut-out valves, selector valves and associated equipment); fully-powered "Servodyne" hydraulic flying-controls (mechanically or electrically signalled).

MAGNESIUM ELEKTRON, LIMITED (stand 201)—Magnesium-alloy castings and wrought products, including the thorium-containing, creep-resistant, high-strength alloys ZT1 and TZ6 (castings), and ZTX (wrought), and components fabricated from sheet and extrusions.

MANCHESTER OIL REFINERY (SALES), LIMITED (stand 188)—Non-destructive testing of aircraft components with M.O.R. flaw-detection fluids; specialized oil-products, including hydraulic-oil DTD585, and a range of "Flexibox" mechanical seals for rotary shafts are featured.

MOND NICKEL COMPANY, LIMITED (stand 140)—Publications giving properties and other information on nickel-alloy steels; nickel-iron alloys; permanent magnets; light-alloys; spheroidal-graphite cast-iron and palladium brazing of high-temperature materials.

B. O. MORRIS, LIMITED (stand 18)—"Morrisflex" flexible-shaft equipment; rotary cutters; files; rasps; mounted points; industrial wire and fibre brushes, and special-purpose machines for jet blade processing.

NEGRETTI & ZAMBRA, LIMITED (stand 255)—Fuel flowmeters; temperature and pressure sensitive units, and capsule stacks for control purposes. Pressure switches; gauges for boost, altitude and pressure; test-bed thermometers; test barometers, and meteorological instruments.

PHOSPHOR BRONZE COMPANY, LIMITED (stand 217)—Castings in copper-base alloys and alloy steels for aircraft components manufactured by the Shaw, C, and CO_2 Processes and centrifugal casting method.

PULSOMETER ENGINEERING COMPANY, LIMITED (stand 271)—"Pulsometer" fuel-booster pumps; models of d.c. motor and 400 cycle a.c. motor-driven pumps, including double-ended designs, also air-turbine driven and hydraulic-motor-driven types.

SAUNDERS VALVE COMPANY, LIMITED (stand 10)—Manual and electrically operated spherical, diaphragm, gate and non-return valves, for fuel, oil, gases, vacuum, rocket fuels, low-pressure hydraulics, and water, used in aircraft and ground installations.

SELF-PRIMING PUMP & ENGINEERING COMPANY, LIMITED (stand 60)—Air turbine; electrically- and hydraulically-driven fuel-booster pumps; methanol/water pumps; cabin-heater pumps; refuelling, transfer and inverted-flight control-valves, non-return valves, fuel recuperators and fuel-system accessories.

Farnborough Air Show

SOLARTRON ELECTRONIC GROUP, LIMITED (stand 259)—A radar simulator and a new double beam oscilloscope, together with a measuring oscilloscope and a range of computer amplifiers.

STERLING METALS, LIMITED (stand 7)—Castings: sand-, die- and precision-moulded in aluminium and "Elektron" magnesium alloys; also in a comprehensive range of magnesium/zirconium/thorium alloys, produced from patterns and dies manufactured by the company. Castings for the Armstrong Siddeley "Double Mamba" engine in RZ5 alloy are on show.

J. STONE & COMPANY (CHARLTON), LIMITED (stand 207)—X-ray quality sand, die- and precision-castings in high-strength aluminium, magnesium-zirconium and copper-base alloys. A particular exhibit is a large magnesium/zirconium-alloy (DTD 748) casting for the lower main gearbox housing for a Westland helicopter.

VOKES, LIMITED (stand 172)—A comprehensive range of filters for all gases and fluids which covers the requirements of the aircraft industry, including latest developments for gas turbines, guided missiles and radio-active dust filtration.

WELLWORTHY, LIMITED (stand 147)—Aircraft pistons and piston rings; alloy die-castings; "Wellseal" jointing compound; sealing rings; "Al-Fin" bi-metallic bonding process, and the "Wellworthy-Ricardo" positive-displacement supercharger.

WESTINGHOUSE BRAKE & SIGNAL COMPANY, LIMITED (stand 261)—Ground power units for servicing, hangar maintenance and engine starting; lightweight rectifiers for main aircraft d.c. power supplies; copper, selenium, germanium, silicon rectifiers with graphs showing their field of application.

HENRY WIGGIN & COMPANY, LIMITED (stand 24)—Wrought nickel-alloys for resistance to corrosion and heat, such as "Nimonic"; standard materials for high-temperature components of gas-turbine engines.

BROWN BROTHERS (AIRCRAFT), LIMITED (site 7)—Manufacturers of hydraulic lifting equipment of all types 3 to 50 tons. Standard types or specially designed to meet any requirement. Hydraulic actuators for conveyors, etc.

LAYCOCK ENGINEERING, LIMITED (site F)—Platform, operated electrically for quick assembly or service of jet engines in a vertical position, permits building up an engine in convenient stages.

Other Exhibitors

The following lists of firms exhibiting products applicable to the foundry industry in some degree, illustrate the comprehensive nature of the show:

Aluminium-alloys

Accles & Pollock, Limited; Aircraft Materials, Limited; B. Attewell & Sons, Limited; Birmetals, Limited; Birmingham Aluminium Casting (1903) Company, Limited; James Booth & Company, Limited; British Aluminium Company, Limited; Brown Bros. (Aircraft), Limited; Chesterfield Tube Company, Limited; Thomas French & Sons, Limited; Garringtons, Limited; High Duty Alloys, Limited; Hughes-Johnson Stampings, Limited; Imperial Chemical Industries, Limited (Metals Division); E. & E. Kaye, Limited; Kent Alloys, Limited; Northern Aluminium Company, Limited; Reynolds Tube Company, Limited; W. H. Sanders (Electronics), Limited; Serck Radiators, Limited; Sheffield Smelting Company, Limited; Southern Forge, Limited; Sparklets, Limited; Sterling Metals, Limited; J. Stone & Company (Charlton), Limited; T. I. Aluminium, Limited; and Wellworthy, Limited.

Bearings

Aero Controls, Limited; Aircraft Materials, Limited; British Manufactured Bearings Company, Limited; E. M. O. Instrumentation, Limited; Silentbloc, Limited; J. Stone & Company (Charlton), Limited; and Tufnol, Limited.

Blades (Gas-turbine)

B. R. D. Company, Limited; Centrax, Limited; Firth-Derihon Stampings, Limited; Garringtons, Limited; Hadfields, Limited; Hepworth & Grandage (Yeadon), Limited; High Duty Alloys, Limited; Wm. Jessop & Sons, Limited; Smith's Stamping Works (Coventry), Limited; and Wilmot Breeden, Limited.

Copper-alloys

Accles & Pollock, Limited; James Booth & Company, Limited; Hughes-Johnson Stampings, Limited; Imperial Chemical Industries, Limited (Metals Division); Mond Nickel Company, Limited; Phosphor Bronze Company, Limited; W. H. Sanders (Electronics), Limited; Serck Radiators, Limited; J. Stone & Company (Charlton), Limited; Telegraph Construction & Maintenance Company, Limited; and Tungum Company, Limited.

Fire-prevention Equipment

Auto Diesels, Limited; Bell's Asbestos & Engineering, Limited; Chesterfield Tube Company, Limited; General Fire Appliance Company, Limited; Walter Kidde Company, Limited; Pyrene Company, Limited; Siebe, Gorman & Company, Limited; and Tecalemit, Limited.

Heat-resisting Materials (Metallic)

British Refrasil Company, Limited; David Brown Industries, Limited; Delaney-Gallay, Limited; Firth-Derihon Stampings, Limited; Firth-Vickers Stainless Steels, Limited; W. T. Flather, Limited; Samuel Fox & Company, Limited; Hadfields, Limited; Wm. Jessop & Sons, Limited; Mond Nickel Company, Limited; Steel, Peech & Tozer, Limited; Talbot Stead Tube Company, Limited; Telegraph Construction & Maintenance Company, Limited; and Henry Wiggin & Company, Limited.

Magnesium-alloys

Birmetals, Limited; Birmingham Aluminium Castings (1903) Company, Limited; James Booth & Company, Limited; High Duty Alloys, Limited; Hughes-Johnson Stampings, Limited; Kent Alloys, Limited; Magnesium Elektron, Limited; Sterling Metals, Limited; and J. Stone & Company (Charlton), Limited.

Mechanical-handling Equipment

Aviation Traders (Engineering), Limited; Brown Brothers (Aircraft), Limited; Electro-Hydraulics, Limited; H.M.L. (Engineering), Limited; Hymatic Engineering Company, Limited; M. L. Aviation Company, Limited; Rollason Aerocessories, Limited; Teleflex Products, Limited; Turner Manufacturing Company, Limited; Western Manufacturing (Reading), Limited; and Westinghouse Brake & Signal Company, Limited.

Metal-inspection Materials and Equipment

Brent Chemical Products, Limited; Dawe Instruments, Limited; Manchester Oil Refinery (Sales), Limited; Philips Electrical, Limited; Tiltman Langley, Limited; and L. M. Van Moppes & Sons (Diamond Tools), Limited.

Paints (Protective and Other Treatments)

Aero Research, Limited; Albright & Wilson (Mfg.), Limited; Brent Chemical Products, Limited; Cellon, Limited; Docker Bros., Limited; Elliot Equipment, Limited; John Hall & Sons (Bristol & London), Limited; Imperial Chemical Industries, Limited (paints division); Kenilworth Manufacturing Company, Limited; Precision Rubbers, Limited; Pyrene Company, Limited; Titanine, Limited; and Valay Industries, Limited.

Steel Castings, Sections, Tubes, etc.

Accles & Pollock, Limited; Aircraft Materials, Limited; Brown Bayley Steels, Limited; Brown Brothers (Aircraft), Limited; David Brown Industries, Limited; Chesterfield Tube Company, Limited; English Steel Corporation, Limited; Fairey Aviation Company, Limited; Firth-Derihon Stampings, Limited; Thos. Firth & John Brown, Limited; Firth-Vickers Stainless Steels, Limited; W. T. Flather, Limited; Samuel Fox & Company, Limited; Garringtons, Limited; J. J. Habershon & Sons, Limited; Hadfields, Limited; Hughes-Johnson Stampings, Limited; Wm. Jessop & Sons, Limited; Laycock Engineering, Limited; Phosphor Bronze Company, Limited; Reynolds Tube Company, Limited; Smith's Stamping Works (Coventry), Limited; Steel, Peech & Tozer, Limited; Talbot Stead Tube Company, Limited; and Tubes, Limited.

Tools (Hand)

Acratork Engineering Company, Limited; Aircraft Materials, Limited; English Steel Corporation, Limited; Garringtons, Limited; Lucas-Rotax, Limited (Canada); Rawlplug Company, Limited; Rotax, Limited; Standard Insulator Company, Limited; and Telegraph Construction & Maintenance Company, Limited.

Tools (Portable Power)

Aircraft Materials, Limited; Desoutter Bros., Limited; General Electric Company, Limited; Hymatic Engineering Company, Limited; B. O. Morris, Limited; Rawlplug Company, Limited; and Tungum Company, Limited.

Welding Equipment

British Oxygen Gases, Limited; English Electric Company, Limited; Murex Welding Processes, Limited; Philips Electrical Limited; W. H. Sanders (Electronics), Limited; and Sciaky Electric Welding Machines, Limited.

Co-operation for Technical Advancement in the British Bronze Foundry Industry*

[*Abstract*]

By A. R. French and E. C. Mantle†

This paper was presented at the 61st annual meeting of the American Foundrymen's Society held in Cincinatti, Ohio, this summer. The Authors took the opportunity to make known in the US the way in which foundrymen in the UK are co-operating to improve the industry technically and to make it still more efficient, and hence, the paper was not a conventional technical one but a description of these activities. What follows is an abstract of the salient points which emerged.

Beginning their account of research co-operation among UK bronzefounders, the Authors said that it had been estimated that there were over 1,000 bronze foundries in Great Britain of which some 80 per cent. employed fewer than 20 moulders. Many were "captive" foundries, making only a limited quantity of castings for the open market, and others made specialized castings, such as valves or pumps, to be sold as complete articles rather than as castings. A large proportion were jobbing foundries making general-engineering castings.

Technical and Trade Associations

With so many foundries and a market small as compared with the US home market, it was obvious, they said, that competition was intense. No restrictive trading practices existed in the industry and individual firms stood or fell on their ability to compete with their neighbours on price, quality and delivery. At first sight, therefore, it might appear that no field for co-operation within the bronze foundry industry existed and that firms would be unwilling to get together to discuss their problems and to advance the common good of the industry. This, however, the paper stated, was far from being the case and the degree of co-operation which existed, especially over technical matters, was now considerable. Within the last 15 years, a flourishing trade-association, the Association of Bronze and Brass Founders, had grown up and in technical matters, co-operation through the British Non-Ferrous Metals Research Association had been developing for even longer.

The Authors then continued by giving a short history of the ABBF since its formation in 1942 up to the present day, and said that it now numbered some 120 firms, and statistics showed that the ABBF members accounted for a very large proportion of the tonnage of castings produced.

Technical Committee

The work of the Technical Committee of the ABBF was next described and examples given of the type of work undertaken. Examples quoted were an investigation carried out, some time ago, into the properties actually achieved in different types of copper-alloy castings as distinct from those in test-bars, to provide data for the satisfactory design of castings; and in the sphere of long-range projects a survey was mentioned which had been made of crucible "life" in the foundries of member-firms which led to suggestions for steps to be taken to get the best service from crucibles. At the present time, the Committee's work was mainly concerned with a revision of British Standards Specifications for cast copper-base alloys. A booklet was in the course of preparation which explained to the engineering designer and other users of copper-alloy castings, the correct application of the various alloys included in the Standards and this would be on sale to the general public.

British Non-Ferrous Metals Research Association

The Authors next described the formation and work of the British Non-Ferrous Metals Research Association from its commencement in 1920 when it had about 20 member-firms to the present day with its membership of over 600 firms, a staff of about 170 and extensive laboratories. At the present time, the Authors stated that about 40 major projects on research were being undertaken and the BNFMRA's annual expenditure was about £175,000. Between four and five problems were received daily and many of these came from firms in the foundry industry seeking advice on such points as the method of gating a given casting, the reasons why a casting had proved unsatisfactory, or suggestions for a suitable alloy to meet a specific application. When necessary, a visit was arranged to the firm in question so that difficulties could be discussed on the spot. The Association's investigations for the bronze-foundry industry dated from about 1935, and for many years, were concerned with factors influencing the pressure-tightness and soundness of phosphor-bronze and gunmetal castings. This work had been a major contribution to the understanding of the casting of these alloys. Effects of gas-absorption by the metal during melting had been thoroughly investigated and practical methods of degassing had been put forward for use on a production scale. Development work in industrial foundries, in which the results of this research had been applied, had led to a considerable economic gain through reductions in the number of scrap castings.

Parallel work on light alloys had been in progress at the same time, and one of the results was the establishment of the mechanism through which grain-refinement of these alloys was obtained by

* Official Exchange Paper from the Association of Bronze and Brass Founders to the American Foundrymen's Society.

† Mr. A. R. French and Mr. E. C. Mantle are, respectively, senior metallurgist of J. Stone & Company (Charlton), Limited, and chief liaison officer, British Non-Ferrous Metals Research Association.

additions of titanium and boron. It was hoped, the Authors said, that research now in progress would lead eventually to new alloys with better casting properties. Other work in progress in the foundry section of the Association's laboratories was concerned with methods of running and gating castings, including methods suitable for the shell-moulding process. In addition to basic research, there was always a demand for short-term investigations and several had been carried out at the direct request of the technical committee of the ABBF.

Co-operation in Action

Much had been done, the Authors said, to make the industry productivity conscious and a grant of funds arising from the Conditional Aid Programme had been of great assistance. The brass-foundry industry had been one of the first to sponsor a productivity team to America under the Anglo-American Productivity Council. The introduction of aluminium pressure-cast patternplates into the UK was almost entirely due to the efforts of members of the productivity team who visited America in 1950. The ABBF and the Research Association had collaborated closely in projects to increase the industry's efficiency. Conditional Aid funds were made available at the time when the industry was showing great interest in two new moulding processes, the shell-moulding process and the CO_2 process. To assist founders to gain the maximum advantage from these new processes, a member of the staff of the BNFMRA had spent several months studying the processes in all their aspects, in order to act as a consultant to the industry on their application.

At the present time, the two Associations were again co-operating over a survey of the various kinds of melting equipment used in the bronze foundry industry. This survey was designed to give the foundryman reliable data on all technical and economic aspects of the use of the various kinds of melting units available—crucible furnaces, reverbatory furnaces and electric furnaces—and would cover such factors as labour charges, fuel consumption and metal losses.* More than 20 bronze foundries in the UK were co-operating in this work by maintaining careful records of the performance of their furnaces over a period of about three months, and these were being collated by the BNF. Not only would there be authoritative data on all types of furnaces to help in selection of the most economic units when changes were contemplated, but each foundry would have the means of judging its own performance compared with others in the industry. This sort of the work, the Authors pointed out, would be impossible or difficult to do but for the co-operative research arrangements. It was certain, they said, that this co-operation would continue to grow in the future for the technical advancement of the bronze-foundry industry of Great Britain.

* Since published, and reviewed in this JOURNAL, August 29 issue, p. 262—Editor.

Corner Scale in Ingot Moulds

Ingot moulds are normally sand cast from hematite iron and are naturally prone to as many kinds of defect as any other casting of this nature. A particular difficulty in this field, however, is what is generally known as "corner scale."

Corner scale is a hard deposit of metal which has seeped over the inside surface of the ingot mould, usually from a point on one or more of the internal corners. Before the ingot mould can go into service, this deposit of metal must be chipped off with compressed-air chisels, which in the case of a badly scaled mould may be a long and costly process. Where the sand core is soft, then the metal forming the scale is fairly easily detached from the parent casting, but where it is hard then the corner scale itself is hard and difficult to remove.

Segregation

It has been established by chemical analysis that corner scale is high in phosphorus. In the case of an ingot mould in which the bulk of the metal assayed 0.34 per cent. P, and the metal in the feeder contained 0.25 per cent. P, that forming the corner scale was found to contain as much as 1.26 per cent. phosphorus. The existence of this high-phosphorus content in the exuded metal, forming corner scale, indicates that it must have arisen from a pool of impure metal, with a low melting point, which has been subjected to severe pressure and which is consequently burst out of its retaining wall of earlier-solidified iron. This pressure is due to the shrinkage taking place in the casting as cooling proceeds in the solid state, and the fact that scale normally is confined to the corners of the ingot mould is an indication that these must be "hot spots" in the casting.

Corner scale can be largely prevented by providing an alternative position in the casting to which segregated, high-phosphorus metal can flow during the cooling and solidification period; in other words providing artificial "hot spots" and keeping them in being for a sufficient length of time. Experience has shown that this can be done by passing a current of air into the top of the mould and into the fluid metal at a pressure of some 15 to 20 lb. per sq. in. directly after casting. This is done by means of a blowing tube let into the top of the mould between the pouring head and the feeder head. The air generates a "pulse" as it emerges through the heads and blowing should continue for at least as long as this can be detected. It stops when the metal in the heads is frozen.

If any difficulty is experienced with keeping the feeder heads open they may be kept clear with the oxygen lance. Practical experience has shown that this device is successful in preventing corner scale or at the worst, reducing it to manageable proportions. It has been covered by provisional patent.

AS AN ADDENDUM to *Information Bulletin* No. 19, the Aluminium Development Association, 33 Grosvenor Street, London, W.1., have published "Recommendations for the Testing of Aluminium Fusion Welds and Welders."

Book Reviews

British Standard Terminology of Internal Defects in Castings as Revealed by Radiography. Issued by the British Standards Institution, 2, Park Street, London, W.1; price 12s. 6d. net.

By introducing this terminology, the British Standards Institution have indeed given considerable guidance to the foundry industry, and any who are interested in the non-destructive examination of castings.

It is difficult to select radiographs which not only reveal the various defects occurring in cast metals, but also lend themselves to photographic reproduction, and the BSI are to be congratulated in their selection. It is wisely pointed out in the introduction that the radiographic illustrations should not in any way be used as acceptance or rejection standards. The classifying of the various defects into groups and then subgroups will greatly assist the radiologist in preparing his reports. The publication will be of further value to the radiologist if used in conjunction with the IBF "Atlas of Defects in Castings."

Reference is made to surface defects showing similar markings on a radiograph as internal defects, and the importance of examining the casting at the same time as viewing the radiograph. This point cannot be overstressed, and should be borne in mind not only by the radiologist, but also by inspecting engineers. However experienced in radiography one may be it is unwise to pronounce judgment by viewing a radiograph without the body."

Illustrations in the book of "gasholes" and "airlocks" show how to differentiate between the two, but unfortunately all radiographs will not be so clearly defined as those illustrated, and it will probably require foundry knowledge as well as radiographic skill to determine the real type of defect.

The publication of this Standard is welcomed; it should be in the hands of all who are interested in the production of sound castings.

R. J. H.

The 24th International Foundry Congress—Congress Papers. In two volumes, published by the Sveriges Mekanförbund, Karlavägen, Stockholm; price 53 Swedish crowns post paid.

All the papers presented at the Congress recently held in Stockholm have been printed here in either English, French or German, with summaries in all three languages. Altogether there are 28 papers of which 15 are printed in English, seven in French, and six in German. It would be invidious to pick out any paper for special mention, as obviously they have been written by specialists in their own particular field. The ground covered is indeed wide and ranges from foundry atmospheres; the speed of sound for evaluating the properties of cast iron; the feeding and pouring of castings; metal penetration into cores; high-duty malleable cast iron; moulding by the CO_2 Process; cupola practice; and spheroidal-graphite cast iron. If there be any typographical errors in these two books, they can be laid squarely on the shoulders of the authors, for the original typescript submitted has been reproduced by a photographic process. This system turned out a thoroughly good job in ample time for the Congress. The reviewer congratulates the anonymous editor of these books, who has taken advantage of a new method of production notably to enrich the world literature of foundry practice.

SILENTBLOC, LIMITED—Viscount Cilcennin has been appointed a director.

Publications Received

European Coal and Steel Community—The High Authority Fifth General Report, April 9, 1956 to April 13, 1957. Published by the High Authority from Luxembourg.

Obviously an annual report emanating from a body which is acknowledged to be carrying out the greatest experiment in international co-operation, must be of great interest to the politically minded. This report, which is not overloaded with statistics, is very readable. It is divided into four parts and 15 chapters. The first part covers the structure and external relations of the Community, and here, not the least interesting section, is a recapitulation of some of the judgments given by the Court of Justice.

Part II covers the operation and structure of the Common Market and deals with the business side of the High Authority. Part III, captioned "Living and Working Conditions in the Community," has much interest because it relates the difficulties of dealing with redundant labour through the closing of mines and iron and steelworks, and recruitment where these are being expanded. The Marcinelle disaster, for example, had an adverse effect on the recruitment of miners for the Belgian pits. One result was the suspension by the Italian authorities of the emigration of their nationals to Belgium. Again, social-security legislation varies in different countries, which in some cases halts the mobility of labour. Part IV is devoted to the long-term policies adopted by the High Authority and naturally terminates with research. The report extends to over 150 pages and while it records great success, it does not hesitate to stress the great difficulties still to be overcome.

FBI Overseas Scholarships. Third Annual Report. Issued by the Federation of British Industries, 21, Tothill Street, London, S.W.1.

It is pleasing to read from this third report that the scheme is progressing favourably, and the arrival of the 174th scholar is announced. Of the long list of British works accepting overseas students, at least 65 operate foundries so that a good impression of the UK foundry industry should be gained by the visitors in many cases. Stress is laid in the report on the social side, and whilst the Federation does its best to ensure an initial welcome and send-off, it is up to the firms themselves to see to this duty in the interim. Nothing is more appreciated by an overseas visitor than an invitation to visit private homes.

Electric Steel Castings for Water Turbines. Issued by George Fischer, Limited, Schaffhausen, Switzerland.

Few firms have a longer experience of the making of steel castings then the firm sending out this beautifully printed and illustrated brochure. Some of these castings enter the category of "heavy" and an illustration is included of the pouring of a Frances runner weighing, as shipped, over 20 tons, whilst the hub of a Kaplan turbine exceeds 30 tons. The mechanical properties of the various grades of steel used are tabulated and a few microstructures are included. Excellent use has been made of colour printing.

FRY'S (LONDON), LIMITED—Mr. F. W. Salter has resigned as a director.

BAKER PERKINS, LIMITED—Mr. J. S. Carolin has been appointed a director.

ASSOCIATED BELTING COMPANIES, LIMITED—Mr. K. B. Taylor has been elected a director.

News in Brief

ROBERT CORT & SONS, LIMITED, ironfounders, have had plans approved to build workshops at Reading Bridge Ironworks, Reading, Berkshire.

A WORKS VISIT to J. Stone & Company (Charlton), Limited, on September 11, has been arranged for the Coventry and district section of the Institute of British Foundrymen.

G. W. S. BURDETT & COMPANY, LIMITED, engineers, Eastgate, Peterborough, Northants, have received permission to erect a foundry on a site at Padholme Road, Peterborough.

W. H. ALLEN, SONS & COMPANY, LIMITED, engineers, Queen's Works, Bedford, who closed their foundry at Queen's Works in order that room might be made available for extensions of the engineering works, have sold the plant and equipment by auction in more than 200 lots.

COCHRANES (MIDDLESBROUGH) FOUNDRY, LIMITED, have received an order worth £250,000 from the Northern Gas Board for 35 miles of 12- and 15-in. dia. spun-iron pipes. They are to be used in the East Coast Grid main which links up the Sunderland and Darlington Divisions.

BAKELITE, LIMITED, 12-18, Grosvenor Gardens, London, S.W.1, have issued a memorandum dealing with dermatitis control in the handling of epoxide resin systems. Founders or patternmakers using these materials are advised to write for a copy (technical memorandum No. E.101).

THE BRITISH CHAMBER OF COMMERCE, Apartado 900, Mexico 1, has organized a British Industrial Centre in Mexico City and a permanent exhibition of British goods is located in the Iturbide Palace. British firms seeking representation in Mexico should write to Mr. John Duncan, the chairman of the Chamber at the address quoted.

A STEADY FLOW of commercial vehicles for Uruguay is at present leaving the factories of Leyland Motors, Limited, where contracts totalling well over £500,000 are in hand for that country. Shipments of vehicles in the last few weeks to Corausa Corporacion Automotriz S.A., Montevideo, the company's agents in Uruguay, already amount to nearly £100,000.

LAST WEEK the s.s. Lairdshill tied up at Sir John Rogerson's quay, Dublin. It has been bought by the Hammond Lane Foundry Company, Limited, for breaking up. It has a gross tonnage of 1,755 and is stated to be the largest ship broken up by the company in Dublin. It was built in 1921 and was on the night service between Glasgow and Dublin.

A NEW PETROLEUM-CHEMICAL PLANT, to be completed by 1959, is to be erected at Fawley, Southampton, for Union Carbide, Limited, London. Estimated to cost £3,000,000, it is the fourth such project proposed for the Fawley area during recent months. The contractors for the plant, which will cover a 25-acre site, are Geo. Wimpey & Company, Limited, London.

ASSOCIATION OF BRONZE & BRASS FOUNDERS: A meeting of members in the London and Home Counties Area will be held at the Clarendon Restaurant, Hammersmith, on Wednesday, September 11, commencing at 12 noon. Luncheon will be followed at 2.15 p.m. by a talk by Mr. C. F. Brook on the implications of the proposals for a European Free Trade area.

WORKINGTON IRON & STEEL COMPANY, a branch of the United Steel Companies, Limited, have commissioned a new £850,000 battery of 53 coke ovens. Replacing a similar battery constructed in 1936, the new ovens, built by the Woodall-Duckham Construction Company, Limited, incorporate a number of design improvements, including a more efficient regenerator system.

SICK PAY AND TRANSFERABLE PENSION SCHEMES in the engineering and shipbuilding industries were urged at the closing session of the annual conference of the Confederation of Shipbuilding and Engineering Unions at Hastings last month. A transferable scheme for the 3,000,000 workers in the two industries would, if adopted, be one of the biggest pension schemes in the world.

THE UNITED KINGDOM TRADE COMMISSIONER in Toronto has been approached by a Toronto firm who are interested in representing UK manufacturers of line-marking machines; material-handling, and general equipment for building and factory maintenance. Firms interested should write to the United Kingdom Trade Commissioner, 119, Adelaide Street West, Toronto, Canada.

THE ELEVENTH CONGRESS of the International Scientific Film Association, to be held in Amsterdam from September 21 to 27, will be attended by a party of some 20 British delegates. The participating countries are invited to submit films for showing at the various sessions during the Congress and 11 British films have been put forward, none of which seems to have any direct connection with foundrywork.

LAST WEEK a number of employees of Leyland Motors, Limited, received bottles of wine and parcels of Australian food from two young Australian girls, Gracie Sutherland of Melbourne and Deidre Mortlock of Sydney, who visited the factories of the company at Leyland and Farington, on behalf of the Australian Trade Publicity Department. After giving a brief talk, the girls ran a short quiz on their country giving the food parcels away as prizes for the correct answers.

A BRONZE HEAD OF A CHILD, sculptured by the Birmingham artist William Bloye (some of whose best-known recent work is the Boulton Watt and Murdoch bronze group at the Civic Centre, Birmingham), has been taken to Zagreb, Jugoslavia, as a gift to that city by the Lord Mayor of Birmingham. The first civic delegation to Jugoslavia, headed by the Lord Mayor, is at present on a ten-day visit to that country. The bronze was exhibited at the Royal Academy this summer.

Mr. A. A. BRAMALL, scrap merchant of Sheffield, has offered a reward of £100 "for information leading to the arrest and conviction of the persons concerned in the robbery at 349, Middlewood Road, Sheffield." On August 28, his 19-year-old brother, Mr. John Mark Bramall, was kidnapped by a gang who stole £200 from him and £1,000 from the firm's premises in Middlewood Road. John Mark Bramall was bound and gagged and driven in a car to London were he was found at Ealing by a night watchman.

INCORPORATED PLANT ENGINEERS: A meeting of the Merseyside and N. Wales branch will be held on September 9 at 7.15 p.m., at the Blossoms, City Road, Chester, when Mr. R. G. Hall and Mr. B. J. Willson will present a paper entitled the "Cost Accountant and the Plant Engineer." On September 11, a paper on "Fire Prevention in Industrial Buildings" will be read at the meeting of the Western branch, commencing 7.15 p.m., at the Grand Hotel, Bristol. The Glasgow branch hold a meeting on September 12, at 7.15 p.m., at the Scottish Building Centre, and the paper will be "Design and Application of Rotary and Reciprocating Air Compressors," by Mr. W. Scott.

Personal

Mr. J. H. RIVERS has resigned from the board of Craven Brothers (Manchester), Limited.

Mr. H. BARON and Mr. A. B. HEELEY, directors of Kayser Ellison & Company, Limited, have been appointed assistant managing directors.

Mr. P. J. C. BOVILL, managing director of Newton Chambers & Company, Limited, Thorncliffe, Works. Sheffield, won a first prize for apples at the Thorncliffe Horticultural Society's 21st annual show on August 31.

Mr. G. W. STEVENS of the staff of Newton, Chambers and Company, Limited, Thorncliffe, Sheffield, has been appointed organizing commissioner for the Boy Scout movement in the Borneo territories of Sarawak, Brunei and North Borneo.

Mr. A. I. MACKENZIE and Vice-Admiral Sir FRANK MASON have been appointed to the board of Metal Industries, Limited. Mr. Mackenzie is a partner in the firm of Brown, Fleming & Murray, chartered accountants, Glasgow, and Sir Frank Mason is the retiring Engineer-in-Chief of the Fleet.

Mr. BERNARD DYER has been appointed general manager, planning division, of F. Perkins, Limited, and Mr. GORDON SMITH becomes deputy general manager, manufacturing division. Both have been deputy planning controllers of the company since 1955 and the new appointments date from September 1.

Personnel manager of the Villiers Engineering Company, Limited, Wolverhampton, since 1948, Mr. H. J. SILVESTER has resigned the position to take up the post with the Staffordshire Education Committee. He is succeeded at Villiers by Mr. JOHN FALLON who has been personnel manager and assistant works manager at James Gibbons, Limited, Wolverhampton.

Mr. NOEL SLATER, chief chemist and metallurgist of Spear & Jackson, Limited, retired on August 30. He received presentations from the directors, staff and workpeople. After training at Sheffield University, Mr. Slater served his apprenticeship with Henry Bessemer & Company, Limited, subsequently working for J. J. Saville & Company, Limited (now Jessop-Saville). He joined Spear & Jackson as chief chemist in 1920.

Mr. FRANK PINDER, a brass finisher at Gummers, Limited, Drummond Street, Rotherham, has just celebrated his 80th birthday. He has been with the firm for 47 years and has said that he is not considering retiring. To celebrate his 80th birthday a luncheon party was given by the works manager, Mr. E. Simpson, and at the party were two of Mr. Pinder's friends—77-year-old Mr. Percy Pratt who has been with the firm for 61 years, and Mr. Henry Parkin who has been there for 62 years. All work a 44-hour week.

After an association lasting for more than 50 years with A. & J. Main & Company, Limited, the Glasgow firm of structural engineers, Sir ANDREW MACHARG has decided to retire from office at the annual meeting, which is to be held in Glasgow on October 8. For the past 20 years Sir Andrew has been chairman of the company. The son of a chartered accountant and himself the senior partner in a firm of Glasgow chartered accountants, Sir Andrew, who is in his 86th year, has given considerable service to the Government in an advisory capacity. He was adviser to the Import Duties Advisory Committee, and subsequently to the Ministry of Supply on the prices of iron and steel products. He was a member of the committee to consider the organization of Navy, Army, and Air Force Institutes, and also of the Hydro-Carbon Oil Duties Committee.

A further step in a career devoted principally to diesel-engine research, design, and development is marked by the appointment of Mr. V. H. F. HOPKINS as manager of engineering in the diesel-engine division of the English Electric Company, Limited. Mr. Hopkins has, since 1951, been group chief engineer for Marshall, Sons & Company, Limited, Gainsborough, and John Fowler & Company (Leeds), Limited. Mr. Hopkins has worked on diesel-engine and fuel-injection development and design for Alfred Wiseman & Company, Limited, C.A.V.-Bosch, Limited, and Sir W. G. Armstrong Whitworth & Company (Engineers), Limited. During his 11 years with the latter company he became successively chief engineer and general manager. At the end of the last war Mr. Hopkins led a British Intelligence Objectives sub-committee team (representing the Admiralty and the British Internal Combustion Engine Research Association) to investigate the German diesel-engine industry. He rejoined C.A.V., Limited, in 1948 as general sales manager of the diesel department. Mr. Hopkins is a member of the Institution of Mechanical Engineers, the Diesel Engineers and Users Association, the Society of Automotive Engineers (USA), and a member of the Council of the Institution of British Agricultural Engineers. He has served on various committees and panels of BICERA and is a member of its Council.

Obituary

Mr. ANDREW BILOS, managing director of Henry Lees & Company, Limited, Motherwell, has died. He joined the firm in 1928 when he helped to float the company.

The French Press announces the death, at the age of 70, of Professor PAUL LE ROLLARD, who has made a number of outstanding contributions to the literature of cast metals.

Mr. A. BRACKEN, O.B.E., who was a former chief engineer in the Scottish Motor Traction Company, Limited, died on August 22. He was awarded the O.B.E. in 1946 when he was the oldest employee of the company.

The death is announced on August 29, whilst on holiday at Palma, of Mr. D. THOMAS, chairman of Glanmorfa, Limited, Llanelly. He was 59 years-of-age. Mr. Thomas joined Thomas & Clement, Limited, in 1914, which company was taken over by Glanmorfa, Limited, in 1939, Mr. Thomas becoming chairman in 1948.

Mr. WILLIAM SMITHSON, until 1955 joint managing director of the Phosphor Bronze Company, Limited, Bradford Street, Birmingham, has died at the age of 68. He joined the firm in 1919 becoming first export manager and then a director. He was a member of Council of the Association of Bronze and Brass Founders.

The death is reported of Mr. JOHN COUPLAND, formerly a director of the Cleveland Bridge & Engineering Company, Limited, Darlington. He was 77. Mr. Coupland, a native of Dumfries, lived for many years in Glasgow before going to Newcastle-upon-Tyne, where he became well known as a civil engineer. He had been retired for about three years.

Mr. SYDNEY MORTIMER, founder and managing director of Sydney J. Mortimer & Company, Limited, engineers, of Northampton, died on Thursday of last week. He received his early engineering training at Bath and then went to Northampton where he took charge of a local engineering firm. He founded the present company in 1923. Mr. Mortimer was 68.

Raw Material Markets

Iron and Steel

The markets have changed very little during the past few weeks. The motor and ancillary trades are taking up more low-phosphorus and hematite pig-iron and there is also a good demand from the heavy engineering and machine-tool industry for these types of iron. No difficulty is experienced in getting supplies of pig-iron as, in most cases, the furnaces have stocks available. In the case of hematite, stocks are higher than they have been for some time and limited quantities are being permitted for export.

Unfortunately, there is no sign of improvement in the light-castings industry, largely engaged on builders' castings and heating and cooking equipment. Consumers are just ordering from hand to mouth and, although the output of common iron has been reduced considerably during the last six months, the reduced supply is more than sufficient to cover present needs. Here again, stocks at the furnaces are rising. There is plenty of refined iron available both for home and export, and makers could do with much more business.

Supplies of scrap for the foundries are more plentiful and foundry coke is passing through to consumers in the allocated tonnages. There is no difficulty in securing foundries' requirements of ganister and limestone. The output of basic iron for steelmaking is extensive and this position is much better than it has been for a considerable time. Substantial stocks both of home and imported irons are available.

The re-rollers are in a good situation for billets as production at the steelworks is high. As outputs at the re-rollers have been smaller recently owing to holidays and a slight recession in trade, it has left them considerable quantities of billets, so much so that some are curtailing supplies from the billet makers. The re-rollers are expecting the demand for light sections, bars, and strip to improve in the early autumn.

Already there are signs of improvement in cold-rolled strip and in sheets, and there remains quite a heavy demand for the small sizes of rounds suitable for ferro-concrete construction. Present prices are higher than those of some Continental competitors and re-rollers are experiencing some difficulty in getting substantial export orders.

The makers of semis are finding some difficulty at the moment in getting rid of defective billets and crops because the re-rollers are getting all they want in prime material.

Non-ferrous Metals

The London copper market remains weak under the influence of declining prices outside the United Kingdom. The US custom smelters have reduced their price by a further ½ cent per lb. to 27 c., which has resulted in copper for export easing to 25¾ c. and scrap to 20½ c. The Belgian price has been lowered to 26.80 fcs. per lb. North European port and New York, while, as mentioned previously, Japan is talking about permitting the export of electrolytic copper to reduce its accumulated stocks. In these circumstances the UK price is not much above the £200 level and is now at its lowest since free dealings were begun four years ago. The small backwardation that appeared for a day quickly gave way to a contango. Stocks in LME warehouses continue to pile up and in total amount to more than 14,000 tons.

The present weakness in copper, as has been pointed out before, arises from the excess of supply over demand. It is necessary, however, to distinguish between demand for newly produced copper and consumption, which outside the United States is running at a rate equal to, and in some cases above, that of last year. This pinpoints the importance to the market of an autumn revival of demand in the United States. So far, signs of such a revival eventuating are not strong.

Tin is also quiet, with demand from the United States disappointing. This is said to be due to the mixed feelings concerning an autumnal revival and consumers are, therefore, continuing to dip into stocks. The present price is well below the London parity. Yet, it must be remembered that the statistical position is good—indeed, better than that for the other non-ferrous metals. The estimated surplus is small and with a part of it already in the buffer stock and the manager of the pool having sufficient funds to absorb the remainder, it is difficult to see the quotation going much lower.

Lead prices in London are tending to lower levels. The feature of the LME market has been the weakening of the near position and the consequent appearance of a contango. In the United States the price is holding at 14 c. per lb., at which level demand is quietly steady.

Zinc is showing strong resistance to shading to lower levels in London. In New York, buying continues to be patchy.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

FORMOSA, September 23—Workshop, hand and machine tools for the International Co-operation Administration Procurement for Formosa. Quotations in US dollars. (ESB/20727/57/ICA.)

INDIA, September 12—Crabs, with cages to detailed specifications. (ESB/20697/57.)

IRAN—Weighbridge for vehicles (30-ton capacity). (ESB/20659/57.)

IRAQ—Shunting locomotive for the Development Board. Preliminary deposit of ID.1,500/-. (ESB/20774/57.)

PAKISTAN, September 23—Vacuum exhausters, and diesel-oil-engine pumping sets for the Department of Supply and Development, Chittagong. (ESB/20750/57 and ESB/20749/57.)

RHODESIA, September 13—Cast-iron Kaffir and bake pots for the Federation of Rhodesia and Nyasaland (Federal Government Tender Board). (ESB/20591/57.)

SUDAN, September 12—Sanitary fittings for the Stores Department of the Sudan Railways. (ESB/20823/57.)

UNITED STATES OF AMERICA—Lathes. (ESB/18401/57.)

UNITED STATES OF AMERICA, October 1—Hydraulic-pump/turbines of 28,000 h.p., for the Power Authority of the State of New York, Niagara Contract. (ESB/20138/57.)

VIETNAM, September 11—Generator sets, marine engines, agricultural machinery, trucks, tractors, trailers and lubrication equipment for ICA Procurement for the Central Purchasing Authority. (ESB/20675/57/ICA.)

THE WALKER METAL COMPANY, of Detroit, USA, has informed the British Consulate, at Detroit, that the company are interested in receiving quotations from UK suppliers, for consignments of the following: Free-cutting brass rod from ¼ to 2-in. dia., round and hexagonal section; finished copper tube for automotive and plumbing use; molybdenum scrap (+96.5 per cent.); hydrogen-reduced tungsten and tungsten scrap, and brass and bronze ingots of all types. Firms interested should write, by air mail, direct to Mr. Ralph Walker of the Walker Metal Company, 8830, W. McNichols Road, Detroit, Michigan. Quotations should show duty-paid prices, delivered Detroit, in US dollars.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

777,160. Joze Germek, 11, Ulica Heroja, Maribor, Jugoslavia.

A chill mould for the production of castings, the two halves of which are preferably symmetrical. The mould is of trapezoidal form in plan view (preferably in the form of an equilateral trapezium). At least one inclined lateral surface is fitted with relatively fixed abutments by which the mould is closed on movement in one direction. A tapering channel is formed on the wider end of the separation surface of the two chill moulds. This channel is adapted to work in conjunction with a wedge-shaped abutment by which the mould is opened on movement in the opposite direction. The idea of this invention is to avoid time-wasting and difficulty which usually occurs when the chill mould in general use is opened after casting.

777,213 and 777,214. Birlec, Limited, Birlec Works, Tyburn Road, Erdington, Birmingham, 24.

777,213 contains a method of controlling or preventing the discharge of molten metal from a container through an opening in the container below the level of the molten metal therein. The method utilizes the electromagnetic forces which are induced in the metal by an induction coil passed around the container to move the metal away from the opening in the container. **777,214** claims the use of a discharge nozzle in controlling the flow of molten metal from a container by elecric-induction means.

Exhibition Briefs

Below are additional paragraphs describing individual stands at the Engineering and Marine Exhibition currently being held at Olympia (closing date, September 12. Previous accounts appeared in the August 22 issue of this JOURNAL).

SPIRAL TUBE & COMPONENTS, LIMITED (*stand* 3, *row AA, first floor, Empire hall*) are showing a new two-man model of their "Air Towel," for high-speed drying of hands, face, etc.; up to now, only a four-man unit has been available.

SIGMUND PUMPS, LIMITED (*stand* 20, *inner row, gallery, National hall*), incorporate in their display the type "G" industrial self-priming pump and a new marine pump range—the Sigmarina. Chemical and refinery process pumps are also being featured.

ALLEY & MACLELLAN (POLMADIE), LIMITED (*rows J and K, stands* 12 *and* 7, *ground floor, Grand hall*), are exhibiting a new range of compressors (from 400 to 2,000 cub. ft. per min. and pressures up to 150 lb. per sq. in.) and vacuum pumps (with displacements up to 3,000 cub. ft. per min.).

MULLARD, LIMITED (*stand* 10, *row DD, first floor, Empire hall*), are featuring ultrasonic machining and cleaning processes, including a new cleaning bath for small components and precision pieces. An "Autoplot" automatic co-ordinate-positioning machine; ultrasonic engraving tool, and ultrasonic generator are also being shown.

THE NEXT INTERNATIONAL FOUNDRY CONGRESS is to be held in Brussels and Liége, Belgium, from September 29 to October 3, 1958. It is being organized by the *Association Technique de Fonderie de Belgique.*

★
STEEL
melted and cast in just over one minute

by the RADYNE
HOOKERCASTER
combining H.F. Induction Melting and Centrifugal Casting.

★ **DEMONSTRATIONS** can NOW be given by appointment at our LONDON premises of similar melts in all metals from light alloys up to steel.

Telephone or write to:

W. J. HOOKER LTD.
239a FINCHLEY ROAD, LONDON, N.W.3
Phone: Swiss Cottage 3281-2-3

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

September 4, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S. 1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £50 0s. 0d. to £53 5s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £76 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 28s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 9s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 12s. 7d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £96 0s. 0d. to £99 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. per unit; over 6 per cent. C, £94 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 33s. 0d. per unit; 2 per cent. C,* 2s. 2d. per lb. Cr.; 1 per cent. C,* 2s. 2½d. per lb. Cr; 0.15 per cent. C,* 2s. 3d. to 2s. 3½d. per lb. Cr; 0.10 per cent. C,* 2s. 3½d. to 2s. 3¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3¾d. to 2s. 4d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 0d. to 23s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £87 19s. 3d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £33 1s. 6d.; tested, 0.08 to 0.33 per cent. C, £34 1s. 6d.; hard (0.41 to 0.60 per cent. C), £35 3s. 0d.; silico-manganese, £44 2s. 6d.; free-cutting, £37 5s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 7s. 0d.; silico-manganese, £44 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 18s. 6d.; acid, up to 0.25 per cent. C, £43 10s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 12s. 0d.; boiler plates (N.-E. Coast), £45 2s. 0d.; floor plates (N.-E. Coast), £44 1s. 0d.; angles, N.-E. Coast, £40 6s. 6d.; joists, N.-E. Coast, £40 2s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 8s. 0d. (under 10 tons to 4 tons, £41 5s. 6d.; under 4 tons to 2 tons, £41 10s. 6d.); hoop and strip, coils, £40 10s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £45 16s. 0d.; black sheets (hand mill), 24 g., £59 4s. 6d.; galvanized corrugated sheets, 24 g., £68 17s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £69 9s. 6d., nickel-chrome, £100 12s. 6d.; nickel-chrome-molybdenum, £112 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £197 15s. 0d. to £198 0s. 0d.; three months, £200 10s. 0d. to £201 0s. 0d.; settlement, £198 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 11½d. per lb., rods, 229s. 9d. per cwt. basis; 20 s.w.g., 263s. 0d. per cwt.

Tin.—Cash, £735 10s. 0d. to £736 0s. 0d.; three months, £737 0s. 0d. to £737 10s. 0d.; settlement, £736 0s. 0d.

Lead (Refined Pig).—First half September, £90 2s. 6d. to £90 5s. 0d.; first half December, £90 5s. 0d. to £90 10s. 0d.

Zinc.—First half September, £73 5s. 0d. to £73 10s. 0d., first half December, £72 15s. 0d. to £73 0s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £107 5s. 0d.; rolled zinc (boiler plates), all English destinations, £105 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £85.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 7¾d. per lb.; rods, drawn, 2s. 11d.; sheets to 10 w.g., 173s. per cwt.; wire, 2s. 4¾d.; rolled metal, 173s. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £143; B6 (85/15), — ; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £192; HTB2 (38 tons), — ; HTB3 (48 tons), — .

Gunmetal.—BS1400, LG2 (85/5/5/5), £178; LG3 (86/7/5/2), £189; G1 (88/10/2/½), £248; (88/10/2/1), £237.

Phosphor Bronze.—BS1400, PB1 (AID released), £262 per ton.

Phosphor Bronze Strip, etc.—Strip, 251s. 9d. per cwt.; sheets to 10 w.g., — per cwt.; wire, 3s. 8¾d. per lb.; rods, 3s. 0½d.; tubes, 3s. 0½d.; chill cast bars: solids 2s. 11½d., cored 3s. 0¾d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 7d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 11½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 10¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £85 0s. 0d. to £87 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, £226; AB2, — .

* Average 68-70 per cent.